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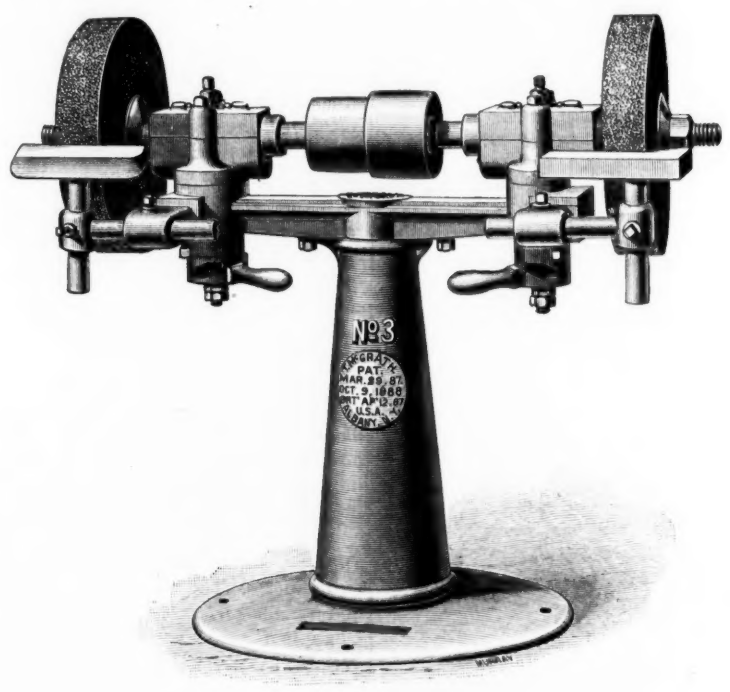
## Yielding Journal Bearing for Grinding Machinery.

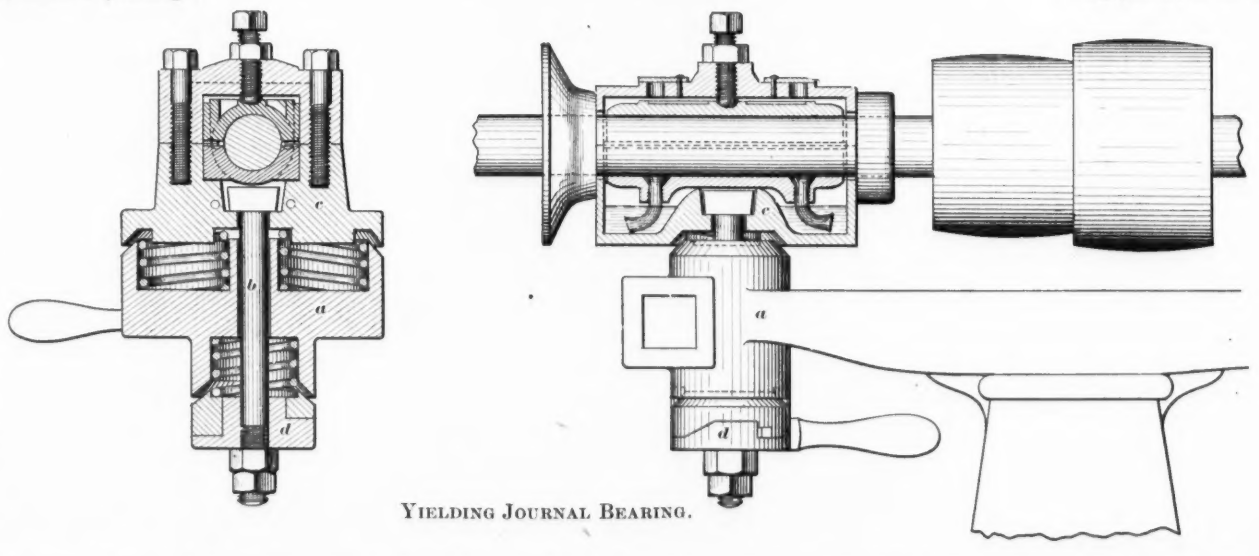
On this page we present engravings of a yielding journal bearing, intended primarily for use on grinding and polishing machines, devised by Mr. Thomas McGrath, of Albany, N. Y. The perspective view shows a grinder provided with these journals, the construction of which is made plain by the sectional view.

The object of the improvement is to provide a bearing which, instead of being rigid, is so arranged as to yield and admit of a wheel placed upon the arbor running true, whether mounted exactly true upon the arbor or not, and thus avoid all jar or vibration in the machine or floor, and also prevent heavy pieces of work, to be ground, being struck a succession of rapid blows, as is the case where the wheel is out of true, but mounted upon a rigidly held shaft; these blows sometimes, in the case of thin plates of large dimensions, resulting in fractures of the castings.

As will be seen by the sectional views, the casting *c* which holds the parts of the box, and to which the cap is attached, rests upon spiral springs, and is held in place by the bolt *b*. Two nuts are on the lower end of this bolt, which are locked together, and above them is a cam *d*, which, when turned to the right, draws the bolt down, and seats the casting firmly on the beveled surface, the similar surfaces at the bottom being of course drawn together at the same time. It is thus seen that, by the simple movement of a handle one way or the other, either a yielding or rigid bearing is secured.

It has been proven by trial that the amount of truing up by diamonds or burr pickers is very much reduced by the use of this bearing, and in many cases entirely done away with, at a considerable saving of time and wear of wheels. The machines are made either for the bench or with a column, as shown, by the Cohoes Iron Foundry and Machine Co., Cohoes, N. Y. The improvement seems an important one, and will, we think, be well received by users of emery wheels.



YIELDING JOURNAL BEARING.

## Exposition Reflections.

BY C. W. CRAWFORD.

In the course of a foray of several weeks on the other side of the Atlantic, during which I have visited the Exposition, and many of the large manufacturing towns and mining districts in England and Scotland, in pursuit of facts and comparisons, and, notwithstanding a lurking suspicion in some places that Americans go over there only to pick up things, I have gotten away with very little booty. While the Exposition is teeming with exquisitely finished machinery of every kind, there are very few novelties, except in the combination of old devices, and some of these are none of the best.

European machinery, as a rule, lacks the directness and simplicity of the American, but in one respect it is superior—in liberal strength and avoirdupois. It cannot be gainsaid the Europeans use more iron than we do, and to good advantage too, but in some other respects the odds are in favor of the Americans. The various unfamiliar combinations are interesting enough, but do not usually amount to actual improvements. The machine tools are elegant in workmanship and polish, but most of them seem to be special machines for a given purpose. There are few, if any, all-round lathes, such as are commonly used here.

All the lathes except three or four have an absurd clamp for a tool holder that would make an American machinist forsake his calling, and the best of these lathes would be considered unhandy tools in an American shop.

The shapers, on the contrary, are all excellent tools, except that they all have a vertical square hole in the flap for the tool, which admits of no adjustment. All of them have the Whitworth quick return, and all are of neat design.

The slotters are all but universally made without a quick-return, but in no other respect are open to inimical criticism. One of these is made with a joint in the column for angular work, and this suggests the idea of a combined shaper and slotter.

The drills are generally weak in the back, and have very little vertical range of adjustment. Several drills have a vise on an extension of the arm opposite the table, which is a decided improvement on what is otherwise a very poor machine. There is no equivalent of the American plain drill press. The radials are all good tools, but some are too elaborate in design, and nearly all have a tiny hand-feed wheel in a place where it is most in the road. Some of these drills run left-handed and use left-hand twist drills.

The increasing popularity of the milling machine is indicated by the vast number of them in the Exposition. If I were to suggest an improvement in these machines it would be more iron. Some of the vertical spiral face mills are made to cut in the direction of the spiral, and some the reverse.

The greatest innovation in machine tools is the Sellers eight to one quick-return planer This machine goes back like a rocket, but reverses absolutely without the slightest shock.

All of these tools shown have certain strong points, either in beautiful and far-fetched combinations or elegant workmanship, or in the special adaptation to certain purposes.

The fewness of machinists' small tools is conspicuous; but whether those people use fine tools or not, they certainly do fine work. There is no exhibit of this line of tools that I could find, except that of Brown & Sharpe.

The relative merits of cast and cut gears is about as unsettled as ever. All kinds are on exhibition. There seems to be an epidemic of skew gears and double skew gears. The latter are all cast, for obvious reasons, but the former are mosly cut. In large machines there is a preponderance of cast gears, but in the small machines the cut gears have it, and the main and back gears are frequently of the same face and pitch, and the pitch is always coarser than the same wheels in American tools.

Leather link-belting is used extensively for all purposes, and is claimed to be superior for lathe shifting belts as well as for main belts. Cone pulleys of small diameter are the universal rule in machine tools of all kinds at the Exposition, and in the shops everywhere. The pulling capacity of belts and pulleys is so well known, and the fact that all planers have pulleys of large diameter and narrow high-speed belts of ample pulling power, is so well known it seems unnatural that this principle should be so stubbornly resisted by makers of tools requiring cone pulleys, Americans as well as the rest. Occasionally a lathe may be found having a cone somewhat larger than the rule, but none as large as the lathe will admit. If the men who operate these lathes were consulted in their get-up, the cone pulleys would be made to fill the space.

I have failed to find any equivalent of the American horizontal face-plate boring mill in the Exposition or in any of the shops. The nearest approach to it is one with a stationary face-plate and revolving tool-bar. But, while they reject our boring mill, they use a wall planer, in the large shops, that we might adopt very profitably. This is a combined slotter and planer. The work is chucked on a stationary table, and the tool is capable of working all over it, vertically and horizontally.

The greatest novelties in steam engines do not consist in new principles, but in mechanical combinations, some of which are absurd. The great variety is no guarantee of superiority, but all of them are well made and highly polished. Corliss engines are a favorite species; some of these are made without the wrist-plate valve motion, and some have a fantastic wrist-plate resembling a devil fish, and some have the original Cor-

liss valve motion in full. Some of the poppet valve engines have the wrist-plate motion, and some have the exhaust valves underneath and the admission valves on top, involving a complex valve gear. Most of the larger engines are compound condensing, and mostly of slow speed, but high-speed engines are numerous enough. The portable engines are of a better class than those commonly used in this country; some of them are double and some compound, and a great many have steam jackets. All the cylinders and boilers are lagged, and all have cut-off valves.

Real live novelties are so few, there is very little for a visitor to catch on to, and very little for Americans to steal, much as they are suspected. One of the mechanical monstrosities is a pair of beam engines having a vibrating center column for the beam. The valves are worked by a plug rod attached to the beam by a sliding tappet motion, and the valves are operated by very springy rocker shaft. One of these engines was disconnected, and it seemed as if the other couldn't hold out much longer.

The locomotives are no doubt very fine to the European eye. The workmanship is certainly the best, and the polish beyond all requirement, but the cramped-up and boxed-in appearance is very unsatisfactory to an American hoosier. They are not the simple machine they seem to be at first sight. The working parts are usually complex and inaccessible. In one locomotive the working parts cannot be seen except through a small hole over the wheel-houses, or by crawling underneath. Some have the valve chests where they are most out of sight, some underneath, and some at 45° on top. All the varieties of valve motion, and all the links—Allan, Walchaert, stationary and shifting, etc.—are represented. Most of them are reversed by a screw and hand-wheel. One or two have steam reversing gear. The throttle levers are double-ended, and work crosswise, and nearly all are handled at the left side. Some are tandem compound, outside connected, and some have the low-pressure cylinder inside and connected to a different axle.

The mining machinery exhibit is not likely to revolutionize the trade. Only one geared double-hoisting engine of the ordinary self-contained variety is worth mentioning. Ventilating fans for cooling mines, having the curve of the vanes the wrong way, the concave side being forward and the curve beginning near the center of the wheel, are among the queer incongruities. Some of these wheels revolve concentric with and very close to the rim of the casing. The sides of the wheel are tapered from the middle to the circumference, and the sides of the casing are straight, hence there is a large space at the sides of the wheel, but next to none at the edge, and no eccentricity.

Another breach of mechanical decorum is a punching machine driven by two reversed bevel face friction wheels, both iron, with one bevel face each, on parallel shafts, the smaller wheel being the driver. This is a friction machine more ways than one, and the physics of it seems to be about as bad as that of the fan above mentioned. The benefit derived from a great bazaar of this kind is very slight unless it shows up an improvement or a decadence, and, in default of either, radical improvement or the reverse, it may serve a good purpose to have pointed out some mechanical misdemeanors. I may get taken by the ear for doing so, but I refuse to apologize.

## Force, Motion and Work.

BY PEDRO.

SIXTH PAPER.—THE RELATION OF MOTION TO GEOMETRICAL MAGNITUDES.

In geometry, lines are supposed to be generated by a point passing through space without regard to the time occupied in doing so. In mechanics, the time is an important element. A line is generated, or, in other words, a body moves along a line or path, in a definite time. In both cases we deal with lines which differ only in the method of their limitation. In geometry they are generally limited by their intersection with other lines. In mechanics they are limited by time; that is, a body generates a line of a given length in a given time, or passes over a certain distance in that time, as we have seen in the second and fourth papers. The whole length of this line is made up of a number of sections equal to the number of units in the time of the motion, as in Fig. 9, the line $A\ F$ being made up of the sections $A\ B$ generated in the first unit of time, $B\ C$ the second section, $C\ D$ the third, etc. These sections may be equal, as we have seen in the second paper, or unequal, as in the fourth paper.

The next magnitude to the line in plane geometry is the area of a plane surface, or

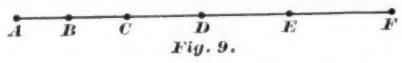


Fig. 9.

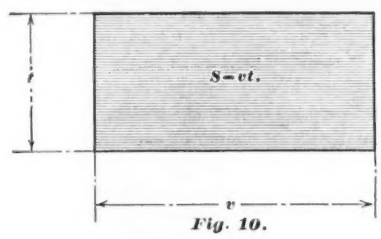


Fig. 10.

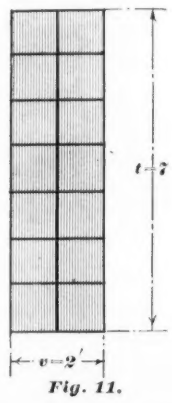


Fig. 11.

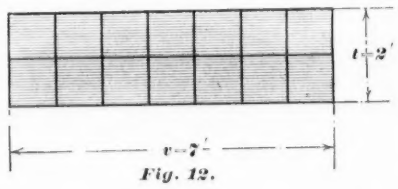


Fig. 12.

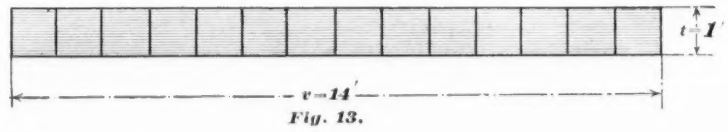


Fig. 13.

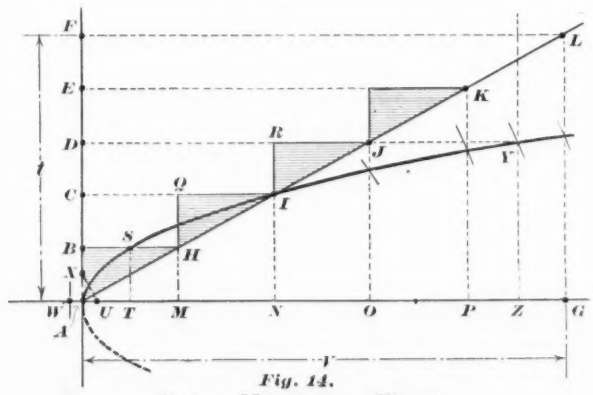


Fig. 14.

FORCE, MOTION AND WORK.

simply the plane. This area is represented by the product of two lines. In its simplest form this area is represented by a rectangle, one of the two lines being its length and the other its width. In other words, one line, called the generating line, or generatrix, passes through space a distance represented by the other line at right angles to the first one, and called the directrix, and the surface swept over by the generating line is obtained by multiplying the generatrix by the directrix. The directrix is variable in its length, while the generatrix may be constant or variable. When it is constant the surface generated is a rectangle, and when variable it is triangular in its general form. In mechanics we have the representative of this rectangle, or triangle, in the motion of matter where the generatrix is the velocity and the directrix the time of the motion. In the second paper, under uniform motion, we have seen that the space is equal to the product of the velocity by the time, hence the space represents the area of a rectangle whose sides are the velocity and time respectively, as shown in Fig. 10. This same area may be made up in several different ways, as shown in Figs. 11 and 12; that is, if one of the little rectangles represents one unit of motion—one *foot-minute*, for example—then Fig. 11 represents a motion of seven minutes, with a velocity of two feet a minute, and the total amount of the motion is $2 \times 7 = 14$ foot-minutes. The same result is obtained by a motion of two minutes, with a velocity of seven feet a minute, as in Fig. 12, $7 \times 2 = 14$ foot-minutes.

Again, a velocity of 14 feet a minute, the body moving one minute, gives a space of $14 \times 1 = 14$ foot-minutes, as in Fig. 13. This band of surface truly represents the *space* passed over by the body; that is, a surface one *time unit* (as one minute) wide, and one *length unit* (as one foot) long constitutes a *motion unit*, which we call a *foot-minute*. If the number of foot-minutes generated in any given time are placed end to end, as in Fig. 13, we get a band-surface whose length in feet is equal to the number of foot-minutes in the motion which is called the *space*.

Motion is always represented, for the sake of simplicity, by a simple line, as in Fig. 9, instead of the surface shown in Fig. 13, because the number of feet in each case is the same, since the length is not altered in its numerical value by multiplying it by unity—one minute. The difference of the nature between a line and a surface, however, should be borne in mind. Motion geometrically considered is always a surface, not a line. All motion may be ultimately reduced to the form of Fig. 13. The motion represented in Fig. 11 generates two foot-minutes in one minute, hence if we take these in pairs, and place them end to end, it will take seven minutes to produce Fig. 13, or 14 foot-minutes. In Fig. 12 we take the foot-minutes in groups of seven, and place them end to end, and produce Fig. 13 in two minutes—14 foot-minutes; that is, the body moves 14 feet in two minutes. The similarity between motion and a plane surface is general, so that it can be applied as a law to all kinds of motion, variable as well as uniform. For example, take Fig. 5, fourth paper. If the velocity line $A\ L$ is known, the space passed over in the time $t$ may be found by calculating the area of the triangle $A\ F\ L$, one side of which is the velocity $V$, and the other side the time $t$. This area is $\frac{1}{2} Vt$. This corresponds to formula 12 ($I$), fourth paper. Here the generatrix is constantly increasing in the same ratio as the directrix, and hence the surface representing the motion is a triangle.

In the same manner we can find the space passed over by the motions represented in Figs. 7 and 8, fifth paper, if we know the form of the curve $A\ F\ G\ H\ I$. The space will be equal to the area of the figure $A\ C\ E\ I\ G\ A$, one side of which, $E\ I$, is the final velocity, and the other, $A\ E$, the time of motion.

It is said that this method originated with Galileo, who is credited with having discovered the laws of uniformly varying motion.

Any problem in uniformly varying motion may be solved graphically as follows: Let us reproduce, in part, Fig. 5, fourth paper, in Fig. 14. Let the lines $A\ F$ and $A\ G$, at right angles to each other, be the reference lines from which the dimensions are measured. The velocity being measured from the line $A\ F$ parallel to $A\ G$, and the time from the line $A\ G$ parallel to $A\ F$; that is, any distance from the line $A\ G$ to the line $A\ L$, as $O\ J = A\ D$, represents the time the body is in motion when the diagram is laid out accurately to a scale. The distance of the same point $J$, on the line $A\ L$, from the line $A\ F$, viz., $D\ J$, is the velocity acquired during the time $A\ D$ or $O\ J$. This is true for all points on the line $A\ L$, hence, to find the direction of this line in constructing the diagram we must have given the velocity at some time of the motion. For example, let us assume a motion whose velocity is eight feet at the end of 4 minutes. Lay off the distance $A\ E$ to some scale equal to 4 minutes, and draw the line $E\ K$ parallel to $A\ G$. Then lay off the velocity $A\ P$, on the line $A\ G$, to the same scale, and draw the line $P\ K$ parallel to $A\ F$. Now draw the line $A\ L$ through the point $A$, and the intersection $K$, of the lines $E\ K$ and $P\ K$, as found. Having drawn this line accurately, any point on it will give the time and the velocity at that time, as $A\ N = C\ I = 4$ feet is the velocity at the end of 2 minutes $= A\ C = N\ I$. In five minutes we have a velocity $A\ G = 10$ feet. Since the acceleration is the velocity acquired in one minute, we find at the end of the first minute $A\ B$, the velocity $A\ M = 2$ feet, or at any interval of one minute as $D\ C$, we find a corresponding difference in the velocity as $R\ J = 2$ feet, which is the acceleration.

Thus far we see that a diagram like Fig. 14 enables us to determine all the parts of the motion, except the space passed over in any given time. As we have seen, this could be determined by calculating the area of the triangle $A\ F\ L$, or, which is the same thing, $A\ G\ L$, one side of which is the velocity and the other the time. But this can also be determined graphically. By studying equation 12 (II.), fourth paper, which gives the space in terms of the time, we find that this is the equation of a parabola whose focal distance is $\frac{1}{2a}$ (one-half of the reciprocal of the acceleration), and whose axis is the line $A\ G$. Hence, to complete the graphical solution in Fig. 14, lay off the point $X$ on the line $A\ F$, one-half of a minute from $A$, according to the scale of the diagram. From $X$ draw the line $X\ U$ perpendicular to $A\ L$, then will the point $U$, where this line ($X\ U$) meets the axis $A\ G$, be the focus of the parabola, and $A\ U$ is its focal distance. Lay off the point $W$ on the axis by making its distance from $A$ the same as the focal distance $-A\ W = A\ U$. Next draw a series of lines parallel to $A\ F$, as $M\ H$, $N\ I$, $O\ J$, etc. These may be drawn at random any distance from each other, unless they were previously spaced equally for some other purpose. Now, to find any point on the parabola, take the distance from the point $W$ to the base of any one of the vertical lines, as $W\ Z$, and with this distance ($W\ Z$) as a radius, and the focus $U$ as a center, describe an arc crossing the same vertical line as at $Y$. The point $Y$ where this arc cuts the line $Z\ Y$ will be a point on the parabola. In the same manner any number of points can be found, after which the curve may be drawn through them, as $A\ S\ I\ Y$; that is, the distance from the focus to any point on the curve is equal to the distance of the vertical line through that point from the point $W$, viz., $U\ S = W\ T$, $U\ I = W\ N$, $U\ Y = W\ Z$, etc.

Other methods of drawing the parabola may be found in various mechanical books, if the student is interested in this direction.

Having completed the diagram as in Fig. 14, the distance of any point on the curve as $Y$, from the line $A\ F$, is the space passed over in the time represented by $Z\ Y$, which is the distance of the same point from the axis $A\ G$. The velocity at the same time, as we have

seen before, is $D\,J$. Thus we find in one minute ($A\,B$) the space passed over is $B\,S =$ one foot, or one-half of the acceleration $B\,H$. In two minutes ($A\,C$) the space is $C\,I = 4$ feet, and the velocity is also 4 feet. In three minutes ($A\,D$) the space is $D\,Y = 9$ feet, and the velocity $D\,J = 6$ feet, etc.

In the diagram we see the interesting fact that, in two minutes after starting, the body moving with a uniformly accelerated motion has acquired a velocity which is equal to the space passed over, and which is twice the acceleration. Also, for any time less than two minutes the space is less than the velocity, and for any time greater than two minutes the space is greater than the velocity.

It will be good practice for any one studying this subject, to work out the examples given in the fourth and fifth papers by this graphical method. Also any other example which may occur to him. In working out any problem by this method it will not be necessary to draw the whole curve of the parabola—only a small portion of it will answer. For example, in Fig. 14, to find the space passed over in three minutes, it is necessary to draw only that portion of the parabola which lies between the lines $P\,K$ and $G\,L$.

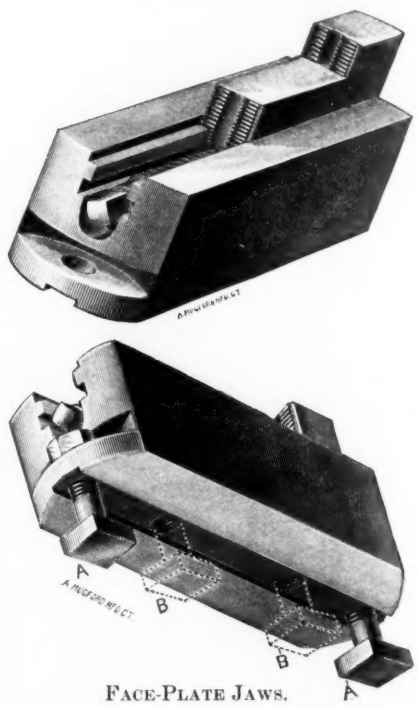
## Improved Face-Plate Jaws.

The Cushman Chuck Co., of Hartford, Conn., have recently improved their face-plate jaws, engravings of which will be found on this page. By providing recesses at each end for nuts, the jaws can be used on face-plates or platens having **T** slots, and can then of course easily be adjusted to any position in the slot by loosening the bolts. At the same time holes are drilled and tapped in the body of the jaw, by which it can be attached to the plate in the old way (as shown by the dotted lines) if desired. The jaws are reversible on the plate; the sliding jaws are reversible in the blocks, and the screws are also reversible, being squared for the wrench at both ends. The sliding jaws have parallel grooves their entire length, and the bearing of the screws in them also extend their entire length.

Four of these jaws attached to the face-plate of a lathe, or to the table of a boring mill, or drill press, etc., make an excellent substitute for the chuck, especially for the larger sizes of chucks, to which they are on many accounts preferable. They are made in two sizes, designated as 10″ and 12″, the 10″ being adapted to face-plates 30″ to 40″ diameter, the 12″ for larger plates and for the heaviest work..

## Lecture delivered before the Brotherhood of the Marine Engineers' Beneficial Association.

On the 13th inst., Mr. Reuben Riley delivered a very interesting and instructive lecture to a large and appreciative audience, in the Hall of the Marine Engineers' Beneficial Association, No. 50. The lecturer commenced by giving a brief description of the ordinary *D* slide valve, and called attention to the fact that in compound engines in which a very high steam pressure is used, a piston valve in the high-pressure cylinder is preferable to the ordinary slide valve, because the pressure on the slide valve will be excessive, unless the slide valve is a balanced one. The lecturer also alluded to the valve motions, which have separate cut-off valves riding on the back of the main valve, the cut-off valves having a right and left-handed screw with which a wide range of cut-off can be obtained without interfering with the action of the exhaust. In marine engines having this kind of valve motion, the cut-off eccentric is set directly opposite to the crank, bringing the center of the crank-pin, center of crank-shaft, and center of eccentric in one straight line. The eccentrics for the main valve are set in the usual way, namely, the advance of the eccentrics is equal to the lap and lead measured from a line drawn perpendicular to the center line of crank. The old-fashioned hook motion was briefly referred to, and in regard to the different devices designed for the ordinary slide valve motions, there was none which gave better results than the ordinary link. In connection with poppet valves, the lecturer described the Stevens cut-off, drawing attention to the toes, which are curved so as to prevent slamming of the valves, and the straighter the toes the quicker the valves are raised and lowered. In the Sickles cut-off the arrangement is such that when the piston has arrived at the desired point of cut-off the poppet valve is disengaged from the lifter and allowed to drop; its velocity in descending is checked, and consequently slamming averted, by means of a dash-pot, which is connected to the valve stem. This




FACE-PLATE JAWS.

cut-off possesses the advantage of a constant lead, no matter at what point the steam is cut off. Hermann Winters' cut-off was highly spoken of, and considered to be nearly as perfect a one as can be made.

The lecturer also drew attention to the fact, that, owing to the high steam pressure at present used in compound engines, improvements in boiler construction had necessarily to be made. Among the notable improvements, the Herreshoff, Morrin, J. W. Walters and E. E. Roberts' boilers were mentioned.

A high ratio of expansion in one cylinder is not beneficial, owing to the condensation and re-evaporation of the steam in the cylinder, hence for a high rate of expansion two or more cylinders give better results. For a condensing engine with one cylinder about 25 pounds of water per horse-power are used; and by expanding in three cylinders, the amount of water is reduced to 15 pounds per horse-power. Allowing eight pounds of water to be evaporated by one pound of coal, the reduction in the amount of coal will be from about 3½ to 1½ pounds per horse-power, and in some cases even less.

The method of calculating the horse-power of a compound condensing engine was then explained, and for this purpose the following example was taken: H. P. cylinder, 8 inches diameter; L. P. cylinder, 16 inches diameter; 500 feet of piston speed per minute; steam pressure in boiler, 100 pounds; loss of pressure, 5 pounds; vacuum, 15 pounds, making a total initial pressure of 110 pounds absolute. The basis of the calculation is the low-pressure cylinder, and ratio of expansion is eight.

To find the average pressure, multiply the hyperbolic logarithm for eight expansions added to 1 by the steam pressure absolute, and divide the product by the ratio of expansion, thus:

Hyperbolic log. of 8 = 2.0794

Add 1

3.0794

Multiply by absolute steam pressure, 110

338.7340

Divide by ratio of expansion,

$$\frac{338.734}{8} = 42.341 \text{ pounds average pressure.}$$

Deduct back pressure of 4 pounds,

42.341 — 4 = 38.341 pounds mean effective pressure.

The area of a piston 16 inches diameter is

$$16 \times 16 \times .7854 = 201.0624.$$

Multiply this by the mean effective pressure,

$$201.0624 \times 38.34 = 7{,}708.732416.$$

Multiply the last product by the piston speed,

$$7{,}708.732416 \times 500 = 3{,}854{,}366.20+ \text{ foot pounds.}$$

Divide by 33,000,

$$\frac{3{,}854{,}366.20}{33{,}000} = 116 \text{ I. H. P.}$$

With the same piston speed we can obtain the same horse-power with a triple expansion, whose high-pressure cylinder is equal to one-half the area of the high-pressure cylinder in the foregoing example, and increasing the boiler pressure to 150 pounds, and allowing twelve expansions. This will make the H. P. cylinder 5¾ inches diameter, intermediate cylinder 9¼ inches, and the L. P. cylinder 15¼ inches diameter. In calculating the horse-power of this engine we proceed as before, that is to say, the basis of the calculation is the low-pressure cylinder; but it must be remembered that we have now 12 expansions. The hyperbolic logarithm due to 12 expansions is 2.4849; add 1,

2.4849

1

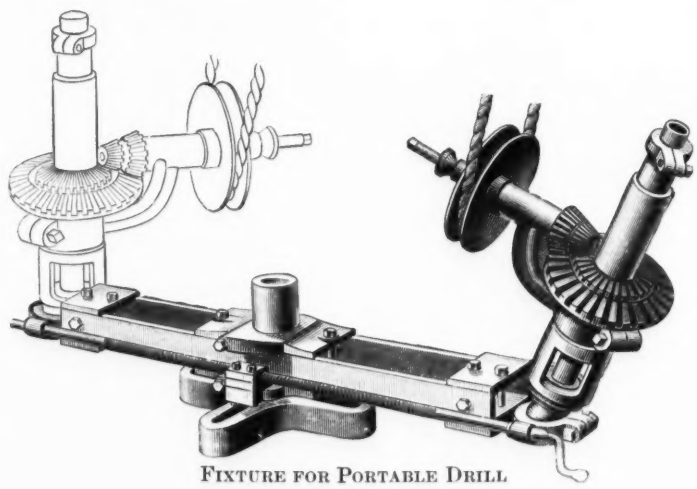
3.4849.

Steam pressure, 150 pounds; loss, 5 pounds; vacuum, 15 pounds, gives us an absolute pressure of 160 pounds. Multiply the hyperbolic logarithm + 1 by 160,

3.4849

160

557.5840.



FIXTURE FOR PORTABLE DRILL

Divide this product by the ratio of expansion, namely 12,

$$\frac{557.5840}{12} = 46.46.$$

Deduct back pressure of 4 pounds, 46.46 — 4 = 42.46 pounds mean effective pressure.

The area of the L. P. cylinder is $15.25 \times 15.25 \times .7854 = 183$ square inches nearly. Multiply this area by the mean effective pressure,

$$183 \times 42.5 = 7{,}777.5 \text{ pounds.}$$

Multiply this by the piston speed, and divide by 33,000,

$$\frac{7{,}777.5 \times 500}{33{,}000} = 117 \text{ I. H. P.}$$

Although there is, in this engine, a drop in the pressure, the temperature will be as before, or nearly so. It may also be remarked that the higher the speed the less change in temperature.

The speaker gave great credit for the advancement in marine engineering to constructing engineers Charles Emery, Charles Copeland, Horatio Allen, Capt. Ericsson, Charles Haswell, George Reynolds, Andrew and William Fletcher, and their designing engineer, Mr. Taylor, who have done so much to bring the beam engine up to its present efficiency.

He further said: "Let us turn to the U. S. Navy. During the dark days of the rebellion, when a navy had to be created, the engineering profession was equal to the occasion, and shed illustrious honors on the profession. We had the illustrious chief engineer B. F. Isherwood, and a host of others. At the present time we have the engineer-in-chief, Commodore Mellville, who braved the rigors of an Arctic region to rescue his companions-in-arms of the Jeanette expedition." The speaker closed his discourse as follows:

"I say to you, my fellow engineers, look to it that you do not stand still, but advance with the times. Make yourself familiar with all that your brotherhood is doing; stand shoulder to shoulder, touching elbows, and may the electric thrill by the spark of genius and intelligence that animates one, be transmitted by this brotherhood to every one of the profession, and then, like Alexander, sigh that you have no more worlds to conquer, ever remembering that you each and every one should strive to reach the top notch, where there is plenty of room. It is only at the foot of the ladder where there is no room to spare."

The Marine Engineers' Beneficial Association, No. 50, have their hall at 287 Hudson street, New York. The object of this association is the elevation and maintenance of the rights of the craft, and the regulation of all other business matters in which the engineer in its jurisdiction may be interested or involved, and no association shall set a standard of wages for its members. The rooms are open daily from 7 A. M. to 9 P. M. All engineers out of employment meet there, and any person needing the services of good, industrious, sober and reliable engineers, can secure them at any time by special message, telegram or telephone. The officers are doing their utmost to secure good speakers to instruct and improve them in their business. Mr. J. W. Walters accepted an invitation to deliver a lecture on Steam Boilers on the evening of 26th inst., in their hall. These lectures, we understand, are open to all interested in engineering, who will be be cordially received.

## Universal Fixture for Portable Drill.

In our issue of Jan. 31 we illustrated and described a new portable drill, having several novel features of interest; giving cuts showing its application to various purposes.

We now present an engraving, showing a special appliance for use with the drill, and which is called by the makers, the "Universal Brace." As will be seen, it consists of a central standard having four slotted arms, by which it is bolted or clamped to any surface. The arm, which is fitted to receive the drill at either end, is attached to this standard in such a manner as to admit of its being turned completely around it, by a worm and wheel, and securely clamped in any desired position. The distance of the drill from the standard can also be adjusted by means of the screw seen at the side, and clamped in any position, the two motions enabling a hole to be drilled anywhere within a four-foot circle. The threaded socket at one end holds the drill at right angles to the surface to which the standard is fastened, while the other end is arranged with a universal joint, which permits of the drill being set at any angle in any direction. The fixture being entirely independent of the drill, it can be adjusted and secured in position first, and the drill then put in place by a few turns of the thread. Plugs, center indicators, bars or other fixtures may be threaded to fit the sockets for facilitating the operation of setting in position or to the desired angle. For a full description of the drill see our former issue referred to above.

The manufacturer is J. J. McCabe, 121 Liberty street, New York City.

## The Globe Triple Expansion Engine.

This engine, which we illustrate herewith, was designed by A. G. Brown, formerly of Pittsburgh, Pa., and is made by John Musgrave & Sons, Globe Iron Works, Bolton, England. Of the engravings, Fig. 1 is a longitudinal section through the cylinders, Fig. 2 a transverse section, and Fig. 3 a section through the valves. As will be seen, each engine has four cylinders, two low-pressure set side by side, and two high-pressure, also side by side, and immediately above the low-pressure cylinders. In place of intermediate cylinders there are annular spaces on top of the low-pressure pistons surrounding the trunks, which extend up into the high-pressure cylinders and form the high-pressure pistons.

The valves, of which there are two, are vertical, and between the two pairs of cylinders, but on each side of the longitudinal center line. These valves are connected to opposite ends of a lever arm, and move in opposite directions; in this way they mutually balance each other.

The two sets of pistons (each set consisting of one high and one low-pressure piston, with the annular space mentioned before forming the intermediate cylinder) are connected by steel piston-rods to the crossheads which carry hardened steel wrist-pins, from which steel connecting rods extend downward to the cranks. These cranks are set opposite each other, or 180° apart, so that the pistons, crossheads, etc., move in opposite directions, and balance each other both as to gravity and inertia, while the cranks themselves, by this arrangement, are balanced when running.

The cranks and shafts are all of steel, and the governor is situated between the two cranks, the main eccentric rod being connected to one end of the lever that works the two valves.

The governor embraces some distinctive features, among which are—that the parts subjected to centrifugal effort—*i.e.*, the governor weights and springs—are not affected by the reciprocating strains. The movement of the weights regulating the cut-off is conveyed to the main eccentric through a secondary eccentric, which relieves the weights of all strain imposed by the working of the valve, and allows them to take their true position, due to the speed, without reference to the effort required to move the valve and its connections. The governor, as usually made, is very nearly isochronal. A variation of one to two per cent. between no load and full load is all that is allowed; even this small amount can be reduced if desired. For example, the governor will not commence to operate until the engine is running within one per cent. of its regular speed, and will pass over its entire range of movement before the engine is running one per cent. too fast. This is a total variation of less than two per cent., and means that when an engine is speeded to run 300 revolutions per minute under load it will not run faster than 304 or 305 when doing nothing, or slower than 300 or 299 when fully loaded. These are the speeds to which they are adjusted in the works, and are constantly verified in their regular working.

In operation, steam is first admitted to the top of one high-pressure cylinder, pressing its piston down and turning the crank and connections. We will, for the sake of clearness, suppose this to be the right-hand cylinder. As the piston moves downward, the valve, actuated by the governor, cuts off the admission of steam, and a portion of the stroke is made with expanding steam. Just before this piston reaches the bottom of its stroke, communication is opened between the right-hand high-pressure cylinder and the annular space in the top of the left hand low-pressure cylinder, the piston of which is then, as the cranks are opposite, at the top of its stroke. This left-hand low-pressure piston is then pressed downward by the steam discharged from the right-hand high-pressure cylinder, and when near the bottom of its stroke, communication is opened between the top and bottom of this cylinder, and the steam which acted on the annular ring when pressing the piston down, acts on the whole surface in raising the piston up; there is, however, always a back pressure in both the high-pressure and intermediate cylinders, which prevents this upward pressure from lifting the connecting rod and crank away from their bearings and changing the direction of the strains, but it materially relieves the crank of the work of raising these pistons, and correspondingly reduces the friction. When the low-pressure piston arrives at the top of its stroke, communication is opened either with the atmosphere or with a condenser, and in the latter case there is a vacuum pulling the piston downward on the descending stroke, and acting in accord with the pressure of steam above the piston to keep the strains constant in one direction.

In the above explanation the course of the steam coming from one high-pressure cylinder only has been mentioned, but it will be readily understood that the same action takes place in both sets of cylinders, and that the strains in all cases are always constant in one direction. A further advantage is that the cushion on the downward stroke of the pistons relieves the crank-pin of friction and wear.

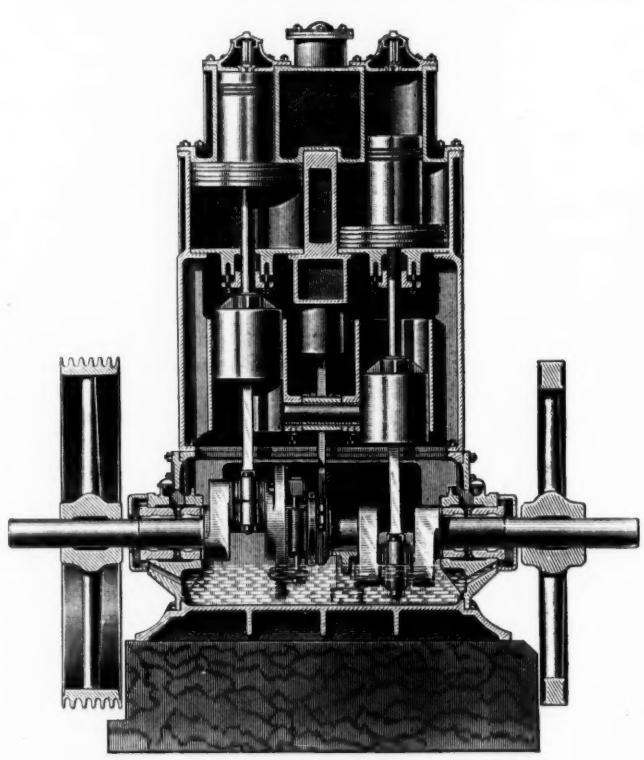


*Fig. 1.*

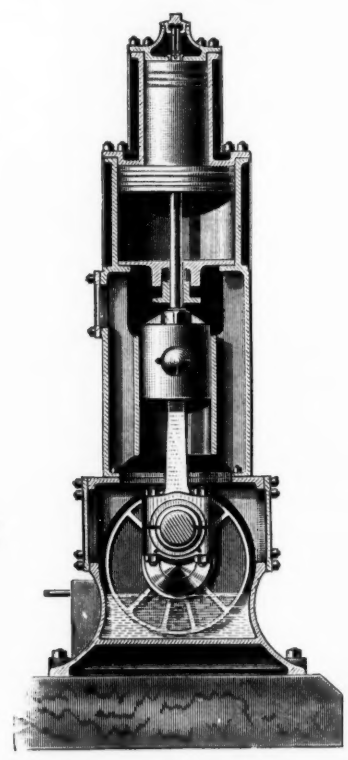


*Fig. 2.*

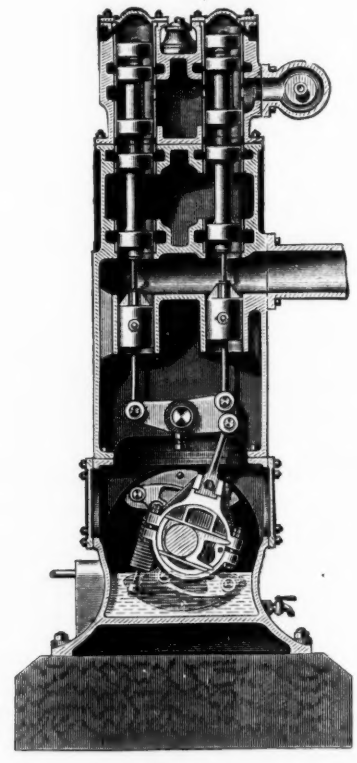


*Fig. 3.*

THE GLOBE TRIPLE EXPANSION ENGINE.

## Shipbuilding on the Clyde.

Remarkable activity in shipbuilding continues to prevail in the various centers throughout the country, and the output during the first nine months of the current year has been something enormous. On the Clyde alone the launches during this period aggregated 239,195 tons, which total has only three times been exceeded since 1877—viz., in 1883, 1882, and 1881, when 293,077 tons, 264,743 tons, and 243,444 tons respectively were put into the water. During the month of September the launches amounted to 40,500 tons, a total which has been but once exceeded during the past twelve years—viz., in 1882, when 42,649 tons were launched. Figures such as these speak for themselves, and show that shipbuilding is remarkably brisk, and this, too, in spite of the many troubles which the builders had with the riveters and others of their employes during the earlier part of the year. It is to be feared that the shipbuilding industry at present is just a shade too brisk to be of long standing, the tonnage that is being added to the Shipping Register being far in excess of that removed.

Notwithstanding this extraordinary output of shipping, orders continue to be received on all hands for the construction of new vessels, the contracts entered into during September on the Clyde alone amounting to upwards of 20,000 tons, while the orders received during the past month will equal, if they do not exceed, this total. The work on hand is nearly equal to 275,000 tons, which is 70,000 tons more than at the corresponding period last year. It is somewhat significant that new orders to the amount stated should be given at a time when there has been a considerable rise in the price of material, and when the freight market is showing a downward tendency.—*The Steamship.*

The profits from Eiffel Tower have paid the cost of construction.

## A First-Class Moulder.

BY S. BOLLAND.

Such is the title applied to many of our trade, who, if their capabilities were examined by the light of modern research, would be found utterly wanting in the principles and laws which govern the art of moulding.

It is not enough, at this day, that a man who takes to himself the above title shall be able to produce a creditable casting from the pattern given him to work from; the probabilities are that everything is found in good form for its production, the methods of manipulation having been thought out by some one in advance of him, either foreman or journeyman, not unfrequently the latter.

Very many of our so-called "first-classs moulders," are clever only in their ability to "catch on" or "pick up" the modes of working going on around them; such men will have their organs of imitation well developed, and in more senses than one will rank only with the parrot as mere copyists or imitators. Others again, having excellent memories, can recall experiences, either of themselves or others, and turn such to good account by avoiding past errors, or by again adopting means which have worked successfully in the past, and thus escape present disaster.

It is not my aim to depreciate in any sense the worth of men whose natural intelligence is their only recommendation, for it must be admited that such men have been in the past great factors in foundry practice, and it is not wise to dispute their authority before examining into the ways by which they have arrived at their conclusions; for the lack of acquired knowledge creates within them the good quality of sharp wit, and their very naturalness suggests to them a mode of reasoning, which, if not strictly logical, will be found in the main to come so near the truth as to command the respect of those who are more thoroughly initiated.

Pass through any one of our best foundries and note the several moulders working at their respective jobs. To the casual observer everything appears to move along smoothly, suggestive of a complete mastery over all the complex and intricate problems to be solved in the construction of the several moulds; in fact, it would appear anomalous to call them at all difficult, when we observe the apparent ease with which they are accomplished.

But we are much deceived if we imagine that this has always been the experience of the foundry in question. On making inquiry we discover that present success is only the result of repeated trials in the past, actual failures discovering to the workman the need of greater care, or increased strength, etc., of the various parts of his mould; and it is not going too far to say that, in many instances, when disaster has followed disaster, chance has come to their relief, and opened up the way of success.

The only men to-day who can claim the title of "first-class moulders" are they who, seeing the end from the beginning, pursue an intelligent course throughout the whole process of forming their moulds, and are able to give a reason for every move they make.

The moulder must possess constructive ability of no mean order, as demands are made upon him in this particular, which call not only for sound practical experience, but for a mental development superior, and only possible in such men as have determined to merit the title above mentioned, and studiously and zealously work to maintain such title. Not only ought the several branches of the trade (loam, green sand, dry sand and core making,) be all equally mastered by him, but also the ability to produce the molten iron for the finished mould, in such mixture and condition as will best serve the requirements of the case.

How can any moulder claim to be "first class," who cannot judge of the fitness of the cores supplied for his mould, and must in all cases trust to the core maker, whose knowledge of the matter may be even less than his own, and very naturally so too, when we consider that, from a misconception of the value and importance of that particular branch of the trade, even green laborers are permitted to produce such cores; a simple case of the blind leading the blind, with the inevitable result of both falling into the ditch. Nor would there be any justice in the claim for excellence, made by any moulder skilled only in one department of his trade, to the exclusion of all the rest.

The basis of excellence consists in the association of all the branches, inclusive of the cupola (last, but not least,) and it is not too much to expect in these days, when the opportunities for the acquisition of knowledge are

so plentiful, that a first-class moulder shall answer to the standard herein laid down.

The really first-class moulder leaves nothing to chance, and, as before stated, "sees the end from the beginning," every step he takes in the prosecution of his work manifesting a previous study of the science of his business. He *knows* that his sand is suitable because, along with his own experience and observations, he has studied the subject thoroughly, and can tell before hand what mixture he needs to bring the silica, alumina, etc., into correct proportions for the work in hand.

The flasks and other rigging he makes will be reliable, because he will have made the necessary calculations as to the weight to be sustained and pressures to be resisted, and proportions his arrangements accordingly. The oft-repeated query of the foundry, "I wonder if this is strong enough?" never enters his mind; he *knows* it is.

Should it be required that a mould must be secured by weights, the first-class moulder never wonders how much weight he ought to place thereon; he has made a careful study of hydrostatics and kindred subjects, and applies the knowledge gained thereby to his every-day practice; by this means all the apparent mystery in moulding is made to vanish in a manner truly astonishing to his shopmates who are so unfortunate as to have joined the "pooh bah" association.

To sum up, ignorance is at the bottom of all this so-called mystery in the foundry. I shall be amply repaid for this writing, if I awaken in moulders a greater desire for knowledge, than has manifested itself hitherto; it is foolish to say, as some do, "Oh! my education was very limited," or "I never went to school." To the former I say, then finish your education now, and to the latter, begin at once; surely there is more pleasure in growing wiser, be it ever so slowly, than there is in remaining ignorant, only to be laughed at by the more ambitious ones around us.

To the young men in our foundries I would say: keep up your education by constant application to study; you need all the knowledge you can get to thoroughly understand your trade; schools of instruction are becoming numerous all over the land, and must not be despised as means for culture in the trades. In these institutions, intelligent workmen may receive such instructions as will perfect their practical education, and make them in every respect worthy the name of "first-class moulder." Lacking the opportunities of such schools, the moulder must make a school for himself. It is important to study. Where one studies is of minor importance. In these times, when opportunities for learning are more than plenty, there is no excuse for ignorance.

## Practical Drawing.

BY J. G. A. MEYER.

NINETIETH PAPER.

643. Figs. 519*a* and 519 represent on a smaller scale the same pyramid which has been shown in Figs. 518*a*, 518; the illustration before us shows the appearance of the pyramid after the cylinder has been removed. The curves $d_3\ b_5$, and $f_3\ b_3$ are the lines in which the cylinder cuts the face ($v\ a\ b$, $v_2\ a_2\ b_2$), and the curve $d_3\ h\ f_3$ is the line in which the cylinder cuts the face, whose vertical projection coincides with $v\ a\ b$, and its horizontal projection is represented in Fig. 519 by the triangle $v_2\ a_2\ d_2$. Our purpose of showing these views of the pyramid is to point out the fact, which beginners may overlook, or not give it sufficient attention, that because in Figs. 519*a*, 519, the axes of the cylindrical surface and the pyramid do not lie in the same plane, the curves of intersections $d_3\ b_5$, $f_3\ b_3$ in the face ($v\ a\ b$, $v_2\ a_2\ b_2$) cannot coincide with the intersection $d_3\ h\ f_3$ in the face directly behind the face $v\ a\ b$. If, on the other hand, we pass the cylinder through the pyramid, as shown in Figs. 516, 516*a* (last paper), so as to bring the axis of the cylinder, the axis of the pyramid, and the edges $v_2\ a_2$, $v_2\ c_2$ in the same plane, the intersection in the face $v\ a\ b$ will coincide with the intersection in the face directly behind it, consequently the curve $d_3\ 4\ f_3$ in Fig. 516*a* is the projection of two curves of intersection, one hiding the other.

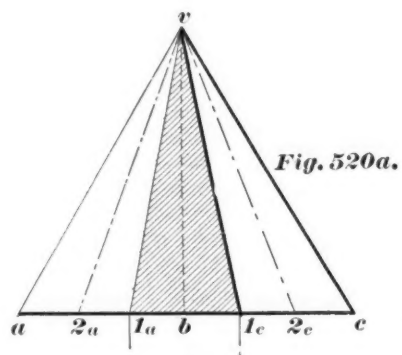


Fig. 520a.

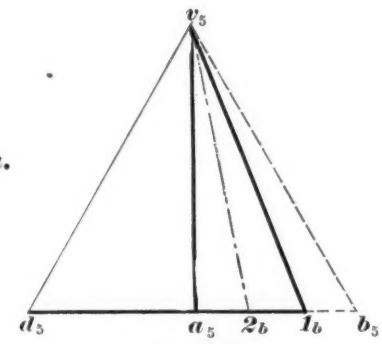


Fig. 520b.

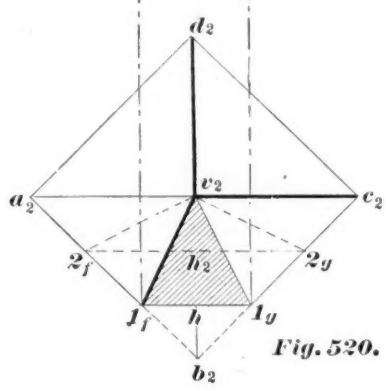


Fig. 520.

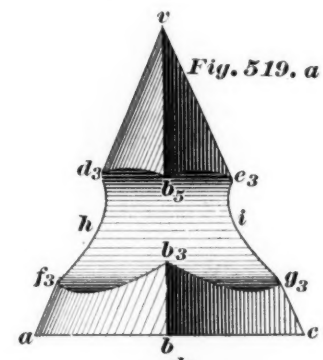


Fig. 519. a

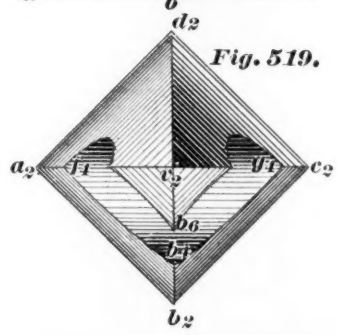


Fig. 519.

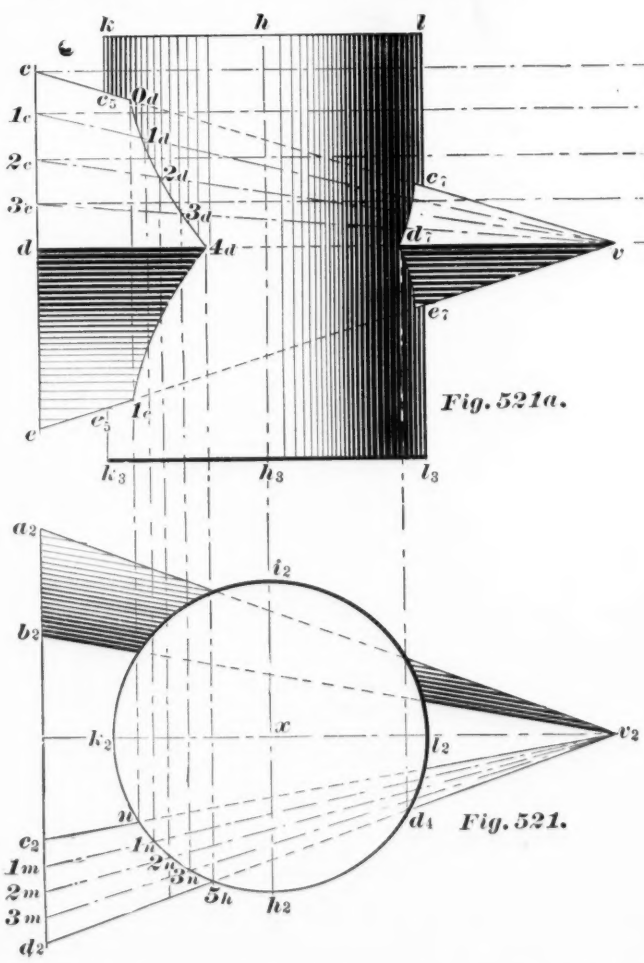


Fig. 521a.

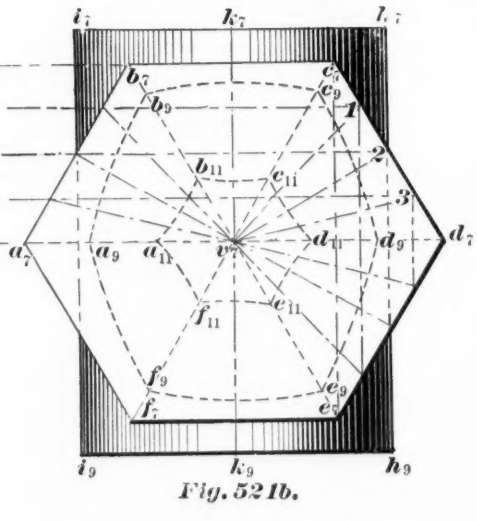


Fig. 521b.

644. In the previous problems we have used auxiliary cutting planes parallel to the axis of the pyramid: and indeed these positions for the auxiliary cutting planes are the best to adopt for the problems we have had, because we can find their solutions with less labor than if we had adopted cutting planes in other positions. But cases will occur in which labor can be saved by adopting different positions for the cutting planes; for instance, in our next problem we will find that it is more convenient to use a number of auxiliary cutting planes, all of which shall be perpendicular to one of the planes of projection, and pass through the vertex of the pyramid. In such a system of cutting planes, one of them will pass through the axis of the pyramid, and the remainder will not be parallel to the axis. Let us now consider the manner of finding quickly the sections made by this system of cutting planes, and thus prepare the way for our next problem.

Let $v_5\ d_5\ b_5$ (Fig. 520*b*) represent a pyramid, and the line $v_5\ 1\ b$ a cutting plane passed through it. This cutting plane is perpendicular to the vertical plane of projection, and passes through the vertex $v_5$. The section made by this cutting plane is represented by the shaded portions in Figs. 520*a* and 520. To find these sections according to the principles previously stated, we simply make $v_2\ h$ (Fig. 520) equal to $a_5\ 1\ b$ (Fig. 520*b*), and through the point $h$ draw a horizontal line cutting $a_2\ b_2$ in the point $1f$, and $c_2\ b_2$ in the point $1\ g$; join $v_2$ and $1\ f$, also $v_2$ and $1\ g$ by straight lines; the triangle $v_2\ 1f\ 1g$ will be the horizontal projection of the section. Through $1f$ and $1g$ draw vertical lines cutting the base line $a\ c$ (Fig. 520*a*) in the points $1a$ and $1c$; join $v$ and $1a$, also $v$ and $1c$ by straight lines; the triangle $v\ 1a\ 1b$ will be the vertical projection of the section.

Let $v_5\ 2b$ (Fig. 520*b*) represent another cutting plane perpendicular to the vertical plane of projection, and also passing through the vertex $v_5$. The section made by this cutting plane is represented in Fig. 520*a* by the triangle $v\ 2a\ 2c$; and in Fig. 520 by the triangle $v_2\ 2f\ 2g$; these triangles are found in a manner similar to that of finding the shaded triangles. Now notice that if we pass through the pyramid these cutting planes, in such a manner as to divide the line $a_5\ b_5$ (Fig. 520*b*) into equal parts, we will find that the corresponding sections in Figs. 520*a* and 520 will divide the lines ($a\ b$, $a_2\ b_2$) and ($b\ c$, $b_2\ c_2$) also in equal parts. If then we pass through the pyramid two cutting planes perpendicular to the vertical plane of projection, passing through the vertex as shown in Fig. 520*b*, and dividing the line $a_5\ b_5$ into three equal parts, we may find quickly the sections in the other figures by simply dividing $a\ b$, $b\ c$ (Fig. 520*a*) each into three equal parts, and from the points of division $2a$, $1a$, etc., draw lines to the vertex $v$, and thus obtain the vertical projections of the sections; and in Fig. 520 we divide $a_2\ b_2$, $b_2\ c_2$ each into three equal parts, and from the points of division draw lines to the vertex $v_2$, thereby obtaining the horizontal projections of the sections. If we use five, six, or a greater number of cutting planes, we divide the lines $a\ b$, $a_2\ b_2$, $b\ c$, $b_2\ c_2$ each into five, six, or as many equal parts as there are in the line $a_5\ b_5$, and from the points of division draw lines to the vertex, and these lines represent the intersections of the cutting planes with two of the lateral faces of the pyramid, or the outlines of the sections made by the cutting planes.

*Problem* 107.

645. *Intersections of cylinder with pyramid.*

Let Fig. 521*a* be the vertical, and Fig. 521 the horizontal projection of a cylinder and pyramid with a hexagonal base, the latter being passed through the former; it is required to find the intersections. Fig. 521*b* is here given simply for the purpose of pointing out plainly the principles involved; for finding the intersections, we do not need it.

Fig. 521. Divide the line $c_2\ d_2$ into any number of equal parts, say four, and through the points of division $1m$, $2m$, $3m$, draw straight lines to the vertex $v_2$, cutting the circumference $h_2\ i_2\ k_2\ l_2$ in the points $1n$, $2n$, $3n$. Also divide the line $c\ d$ (Fig. 521*a*) into the same number of parts (four), and through the points of division $1c$, $2c$, $3c$, draw lines to the vertex $v$. Through the point $5n$ in which $d_2\ v_2$ cuts the circle (Fig. 521) draw a vertical line cutting $d\ v$ (Fig. 521*a*) in the point $4d$; through the point $3n$ draw a vertical line cutting $3c\ v$ in the point $3d$; also through the points, $2n$, $1n$ and $n$, draw vertical lines cutting $2c\ v$, $1c\ v$, and $c\ v$ respectively in the points $2d$, $1d$ and $0d$, join these points by a curve, this curve will be the intersection of the lateral face ($c\ d\ v$, $c_2\ d_2\ v_2$) with the cylindrical surface. The curve $1e\ 4d$ is found in a similar manner; it is exactly like the one just found. These curves are portions of an ellipse, but they coincide nearly with the arc of a circle, and may be described with the compasses.

The curves drawn through the point $d_7$ are also found in a manner similar to the foregoing. For instance, through the point $d_4$ (Fig. 521) draw a vertical line, cutting $d\ v$ (Fig. 521*a*) in the point $d_7$; again, through the point in which the line $3m\ v_2$ cuts the

arc $l_2\ d_4$, draw a vertical, cutting $3c\ v$; this point will be another one in the curve. The other points are found in a similar way. The curve joining these points is the curve required.

If our remarks in Art. 644 have been understood, the principles upon which this construction is based will be readily recognized. The vertical lines drawn through the points $c_7$, 1, 2 and 3 (Fig. 521*b*), and terminating in the side $d_7\ e_7$, represent lines in which the base of the pyramid is intersected by auxiliary cutting planes, which are perpendicular to the horizontal plane of projection, and pass through the vertex of the pyramid, and the lines $v_7$ 1, $v_7$ 2, $v_7$ 3, are the intersections of the auxiliary cutting planes with the lateral face $v_7\ c_7\ d_7$ of the pyramid. The plane represented by the line $c_7\ e_7$, will, of course, pass through the edges $v_7\ c_7$ and $v_7\ e_7$. Since this plane is perpendicular to the horizontal plane of projection, it will be represented in Fig. 521 by the line $c_2\ v_2$; and here we see that it cuts the cylindrical surface in an element which is represented by the point $n$. In Fig. 521*a* the vertical drawn through the point $o\ d$ is a portion of this element, and, since this element and the edge ($c\ v$, $c_2\ v_2$) lie in the same plane, it follows that the point $o\ d$, in which the line $c\ v$ intersects the vertical through $n$, must be a point in the curve of intersection. Now let us consider the next point. We have already seen that line $v_7$ 1 (Fig. 521*b*) represents an intersection of a cutting plane with the lateral face $v_7\ c_7\ d_7$, and this lateral face is represented in Fig. 521 by the triangle $v_2\ c_2\ d_2$, and in Fig. 521*a* it is represented by the triangle $v\ c\ d$; the lines $1m\ v_2$, $1c\ v$, are the projections of the line in which the cutting plane cuts this face; we also see that, since the cutting plane is perpendicular to the horizontal plane of projection, and because it is parallel to the axis of the cylinder, it will cut the cylindrical surface in an element which is represented by the point $1n$; in Fig. 521*a*, the vertical through $1d$ represents a portion of this element, and the point $1d$, in which this element cuts the line $1c\ v$, must be a point in the curve, because $1c\ v$ and the vertical through $1d$ lie in the same plane. Similar reasoning applies to the other points, and proves the correctness of the construction.

The curves $a_2\ b_2$, $b_2\ c_2$, etc., in Fig. 521*b*, are the intersections of the pyramid and cylinder as they will appear when the axis of the pyramid stands perpendicular to the vertical plane of projection. The manner of finding these curves will be explained in the next article.

*Directions.*—In the space marked Prob. 107 draw the vertical and horizontal projection of cylinder and pyramid, as shown in Figs. 521*a*, 521. Length of cylinder, 10 inches; diameter, 7 inches. Altitude of pyramid, 13 inches; hexagonal base, 8 inches across the sides; the axis of pyramid is to be 4½ inches above the base of the cylinder. Find the intersections. Use 3-inch scale.

## LETTERS FROM PRACTICAL MEN.

### Lathe Centers.

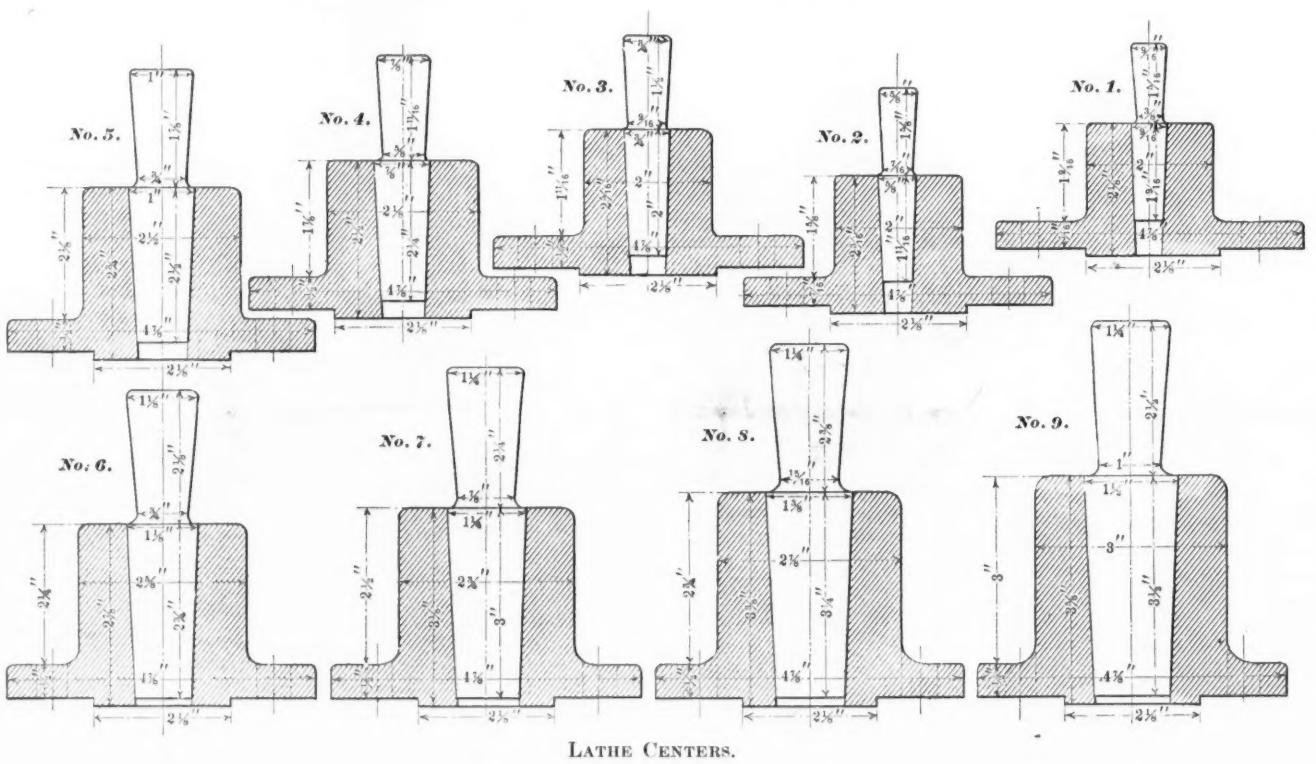
*Editor American Machinist:*

I have just read the article in your issue of Oct. 17th, referring to a system of lathe centers. I must confess that the wording of the article is so vague that I hardly understand what it was written for, but as Mr. "Jarno" has brought my name into the subject of his dreams, and as his explanation of the dreams are rather hazy, I cannot make out whether he is reflecting on the lathe center system adversely or not.

As you took the trouble to notice the system, and it seemed to you worthy of making a note of, when you must have been overwhelmed with information on many subjects, during your trip to the Exposition, I think it due to you to explain to your readers, that it is by entirely avoiding the complications suggested by Mr. "Jarno," that we have been enabled to carry the system out in a very simple form. We use seven or eight sizes of centers only, and of which a blue print is enclosed. You will notice that the centers are shorter than those used in American lathes. We have followed the usual custom here in the length of the centers.

Our American friends always exclaim, "Why do you make the centers so short?" whereas the English inquire about the American lathes, "Why do they make the centers so long?"

When we commenced the lathe center system, we had only about 10 lathes, and it was a simple matter to bore out the head-stock and tail-stock spindles to the nearest standard center plug which it would bore up to; occasion was taken to do this when the lathe could be spared for a few hours.




LATHE CENTERS.

As we have added more lathes to our plant from time to time, the first operation when the workman was started upon the lathe was for him to take one of the center plugs from the tool-room, and bore the lathe spindles out. His lathe then became part of the system, and he could at once commence obtaining centers from the tool-room. All this seems so very simple that it is hardly worth an explanation, and I feel rather surprised that your Mr. "Jarno" should have been led to think that it was necessary to have a mass of fixtures and tools, together with a special grinding machine, to arrive at such a simple matter.

I think I remember your remark, when on this side of the water, that the English had a way of accomplishing many results, without going a long way round. Certainly Mr. "Jarno's" friend went the longest way round to accomplish his object.

I might explain that the collars into which the center plugs fit, are arranged to go on to the face-plate of the grinding machine, also on the lathe face-plate for turning down the points, so that in this way they answer two purposes.

Our stock of centers are kept up by boys, to whom we pay a few shillings a week only. There is not a large stock of centers to be kept in hand for 100 lathes, as a dozen of each size will go a long way.

We allow the old centers to accumulate until there is a considerable stock; they are then annealed and turned down ready for grinding.

We find this system very convenient in the works, and also in our regular standard manufacture of lathes. When the lathes are completed, we can take any number of standard centers ordered, from off our stock, to send with them. As you remarked at the time of your visit, the whole matter is so simple, that the only point to seriously wonder at is why every works don't adopt the same.

GEO. RICHARDS.

Broadheath, England.

### The Round and the Square Chimney.

*Editor American Machinist:*

I am thankful to friend Le Van for his notice of my reckless statement in regard to the round chimney.

It is another evidence of the consequences of trying to write of something one knows nothing about.

I simply supposed that a chimney operated as a tube, through which the air is trying to flow, and fancying that friction was no advantage, and that there would be less of it in a round flue than in a square one, concluded that a round chimney was best, as a matter of fact; I have long had a notion that a semi-hexagon chimney breast would look better than a rectangular one, and took that way to bring it before the architects.

If Mr. Le Van intends to be understood as believing a chimney 5½ feet square is better than a round one 5½ feet in diameter, likely no one would question the soundness of that belief. But I should not expect a square chimney of the same area, or the same friction surface, to be equal to a round chimney of the same area, which would be nearly 6¼ feet in diameter, or one with the same friction surface, or number of bricks, 7 feet in diameter, either of which one would suppose better than the 5½ feet square chimney.

JOHN E. SWEET.

### They Still Explode.

*Editor American Machinist:*

I was interested in your editorial a few weeks hence, entitled: "They Still Explode." Let me relate a little experience:

Not long ago I was sent to Northern New York to repair a saw-mill engine. When I had nearly completed the job I was approached by a man who asked me to go with him to see what the trouble was with his threshing engine. He couldn't get his boiler to keep steam, especially when the pump was working. I went to see the unruly machine, and what a sight! It had been made by a well-known firm, but was coated over from fire-door to smoke-stack with grease and straw.

I asked him how long since he had blown out the boiler, taken out hand-hole plates and cleaned the water leg.

He replied: "I have run this engine two years, but I never knew before that I could clean out the boiler. The most I could do was to pull out the ball to the end of the lever, then hang on a chain and let her go till she got to 140 [that was as far as the gauge was graduated], and then open the door and throw on a shovelfull of dirt to smother the fire; but even then she won't stand up to the rack when I start the pump."

I found a weather-beaten monkey-wrench, and after a good deal of hard work, and, I fear, some words bordering on profanity, succeeded in loosening the hand-hole plate bolts. Then, after considerable difficulty, we succeeded in persuading the plates to let go of the corroded sheets. Then I found that from eight inches from the bottom the three-inch water space was packed solid with mud and clay.

It is no wonder that saw-mill, threshing, and traction engine boilers continue to "let go." There should be a law compelling the owners of all boilers to employ an intelligent and capable man to run their engines. They have no right to endanger the lives and property of outside parties by criminal carelessness.

C. E. K.

### Every-Day Tests of Steam Plants.

*Editor American Machinist:*

The average owner of a steam plant is very often called upon to buy this or that new improvement, which has for its aim the saving of fuel. After he has operated his plant for some length of time, it is generally the case that he has become totally indifferent to all such appeals. Clear-headed men of business soon find out that due allowance must be made from the claims of the party whose new invention will figure out a saving of 25 per cent., and he knows that figures like these have proved unreliable. Knowing just enough about steam, its economical generation and use, to realize his ignorance of the subject, and not having time to study out its many problems, he comes at last to the conclusion to buy nothing new, however plausible may be the arguments in its favor. So he puts on the armor of defense to all suggestions, to all improvements.

Thus far he has logically carried out the business law which bids him let alone mere theories until some one else has demonstrated their truth or falsity. Perhaps it may be safe to say that among this class of men are many who really desire to fix this, or put in that improvement, which may cut down the coal bill; but the burnt child dreads the fire. I have known such men, and have tried to save them from mere sharks.

Our steam user is, by highest authority, advised to buy an indicator, put it in the hands of his engineer, and await the returns. Should his engine be in careful hands, he may fail to detect any saving, while the engineers may suggest that the indicator doesn't apply to boilers or heaters. Remembering the elegant diagram displayed by the party from whom he bought the engine, and the calculations from it regarding water per horse-power, pounds of water per pound of coal, etc., and knowing that some way or other the coal bills are higher, he loses confidence either in the indicator, the engineer, or the plant.

No one has told him that the indicator does not account for all the water used, and he wants to know where every ounce of it goes,

and he is right. More and more are men straining in every department of mechanics to get at exact cost, and to know the bed-rock on which they base calculations. Why not in the engine and boiler-room? How can cost there be accurately known? Let us see if it can be done. We deal in two things—coal and water. Put in scales and weigh every pound of coal; weigh back the ashes, thereby obtaining data for determining the percentage of ashes, and keep a coal-book showing each day's account. I venture the assertion that the scales will be the best-paying *little* investment that can be made, not only in satisfaction to yourself, but to your engineer, as it places in his hands the means of knowing what he burns, and, as you make him more skillful, accurate and careful, the results are your financial benefit.

But the next step is the water. You are told that a pound of coal should, has, and can evaporate a certain amount of water; you have read of the duty tests conducted by steam experts, how they weighed the water as well as the coal, and arrived at definite results. To weigh the water daily, and the coal, would show the efficiency of the plant taken as a whole, and that is what the steam-user wants; for, whatever may be the economy of the boiler, or engine, or heater, taken separately, it's the efficiency of all these combined that he is interested in; that he must pay for in the coal pile. To weigh or measure the water accurately, continually, is the problem. In many cases it may be done cheaply by means of two tanks. With all the water meters in the market I am not familiar, yet I believe meters are made and can be made to fill this want. Let a demand spring up for such a meter, and it will appear. A test of a Worthington meter, after adjustment, showed an error of one pound in 390 pounds. There may be even better results by the same or other meters. Of course the perfect meter must be of unquestioned accuracy, capable of long service without impairing its truth. It should be located where the supply is of practically even temperature, and that low, and its readings taken daily, thus making each day a duty test. Putting such an outfit into the hands of a good engineer, along with the indicator, and requiring a weekly report of coal used, and water evaporated, would give one the data necessary to base any further improvements on, and a safe way to test any which might be applied. From such reports the engineer could and would see that everything was kept in the best shape, because he would know that such efforts would be seen and appreciated.

What a powerful stimulus would be given to manufacturers of steam appliances under such a regime. Steam users would compare notes, and never be satisfied until their expenses were as low as the lowest, and the plug engineer would "take the road," while the old engine, running just because the wheels go around, would start on a grand expedition to the cupola. The scale would have to come off that boiler if it brought the iron along, for Brown is evaporating nine pounds of water with one pound of coal, and if the old boiler can't go through the gate she will have to go over the wall. It would not take long to discover whether it paid to heat by exhaust steam or live, or to see whether the traps were in good order. But what a disaster this would be to our friend whose little improvement will save 25 per cent. The game to him would be over.

Believing that such a duty test as herein described is possible, practical, and within the power of steam users to avail themselves of, I ask your readers to give us the benefit of any suggestions or plans they may have bearing on this subject. DUPLEX.

### The Swinerton Locomotive Again.

*Editor American Machinist:*

Several months ago most of us probably noticed some accounts in the daily papers about a new means of obtaining increased traction in the locomotive. The contrivance consists of substituting for the common driving wheels, wheels whose perimeters are polygons of many sides. The facets on the circumferences of average drivers were described as from ¼" to 2" long. The AMERICAN MACHINIST noticed it at the time, but evidently considered it as "moonshine," as I certainly did myself.

During my travels this summer I heard that the wheels in question had been on trial on a locomotive belonging to the Boston & Maine R. R. (or Boston & Lowell, I forget which,) and that the device actually did result in increased traction, and decreased coal consumption, for the same work. It was also said that the wear on the rails was no more noticeable than with ordinary drivers, and that the motion was not any more trying to the engineer. These statements were made by a man who should know what he was talking about. I have no evidence at all to present, and no data which should tend to change my opinion, but I have done some meditating since I heard the reports this summer, and asked myself, "If this is so, what can be the explanation?" If facts are to be sprung on me finally, that furnish evidence which cannot be disgorged, I want to have some means of digesting it.

Let us look into the matter a little. If the rail is regarded as impenetrable, the facets cannot have any effect to increase friction, because the pressure or weight remaining constant, the friction is independent of the surface. It is barely possible that the inertia of the engine, which really has in this case a slight motion up and down as each facet passes on, may make the force applied to the rail when the whole weight comes on the edge between two facets something like a blow, the force of which in pounds may amount to more than the simple weight of the engine; but then the friction while the weight is on a facet would be less than the constant friction developed by a round wheel, and the mean would probably not show gain in traction from this cause.

If the rail is not considered impenetrable, then the facet would increase friction, but mar the rail too apparently, *unless* it may be that the succession of blows given by the edges are *within the elastic limit of the rail*. If this be taken as so, and it be admitted that each edge makes a depression in the rail, but that, the blow being within the elastic limit of the steel, the depression disappears and the surface of the rail springs back into place as it were, we may possibly have a rational explanation.

Mind, I do not say there *is* more traction, but they say facts are coming which will prove it, and if so their arrival is sure to be of interest. Evidently the circular wheel *does* work, and evidently a square wheel would not, nor would a hexagonal one. *If* facets can be cut on the circumference of a driving wheel that will increase traction and not hurt the track, I can *at present* see no explanation of the circumstance other than that here presented. J. TORREY.

### India Ink.

*Editor American Machinist:*

Referring to the article on testing India ink, in your issue for Oct. 24, I must take exception to the concluding paragraph in which all liquid inks are condemned.

For the past eight or ten years I have used Higgins' American drawing ink exclusively for both drawings and tracings, and with unbroken satisfaction. It is black enough to satisfy the most critical, and gives less trouble than any India ink I ever had the good luck to get. In addition to these merits it has the additional one, that flies will not touch it, and this alone far more than offsets all the imaginary objections that have been urged against it.

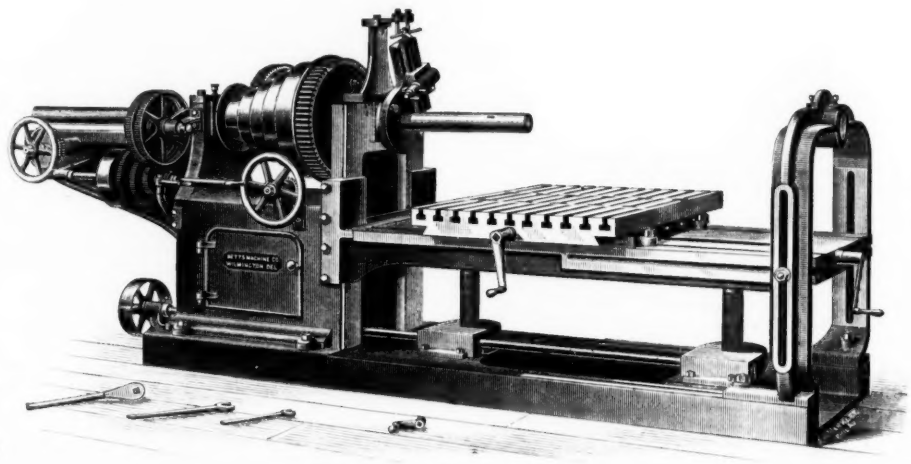
These remarks apply to the brand known as the general (red label). The Waterproof (white label) I have not found suitable for tracings. Many dealers have a habit of sending the Waterproof, unless ordered to the contrary, and to this no doubt is due the lack of success which has attended many trials of it. If your readers will try one bottle of the general brand, they will pitch their ink-slabs, water cups and all of their messy accompaniments into the street, and wish themselves younger, so as to be able to enjoy longer their delivery from the everlasting grind of mixing ink. FREDERIC A. HALSEY.

### Prefers Hydraulic Power.

*Editor American Machinist:*

Noticing the inquiry of your correspondent, in your issue of Oct. 31, Question 405, leads me to suggest that it might be better for him to use hydraulic power, and so do away with the question of a screw. Hydraulic machines for doing the work he refers to are common, cheap, and generally more satisfactory than other power.

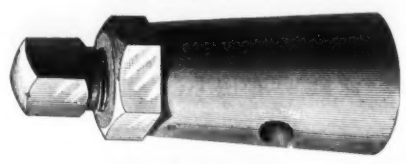
W. S.



HORIZONTAL BORING MACHINE.

### The Manufacture of Dynamite Guns in Birmingham.

In order to give the War Office an opportunity of judging of the comparative merits of the Graydon and Zalinski systems of torpedo warfare, a trial will take place some time next year at Portsmouth, not—as in America—with dummy shells, but with charged ones. With a view to this trial, the syndicate formed for working the Graydon patents—numbering now 38—have contracted with Taunton, Delmard, Lane & Company, Limited, of Birmingham, for the manufacture of a 15in. torpedo projector. This will be 30ft. long, as compared with a length of 55ft., which is necessary for throwing the same sized projectile containing 600 lb. of dynamite from a Zalinski gun. And whereas the range of the Zalinski is a little over a mile, the Graydon projector will land its torpedo in a fort or on a ship three miles distant. Messrs. Taunton, Delmard, Lane & Co. have obtained the contract on account of their unique success in making tubes to resist these heavy pressures, compressed air work being one of their specialties. At present only the 15in. gun has actually been ordered, but negotiations are proceeding, as the result of which it is hoped the order will come to Birmingham for a 6in. siege gun, throwing a torpedo charged with 70lb. of dynamite. The whole of the equipment of the guns, including carriages, compressors and boilers, will be made by the same contractors. The larger gun, with its complete outfit, costs about £10,000, and though the full complement of compressors will not be furnished with the experimental weapon, the present order is obviously an important one as affecting local trade. The first gun will take till Christmas to complete.—*The Practical Engineer* (London).



### Steel Screw Block.

The screw block illustrated herewith is intended for use on the planer, drill press or for other work, and is made entirely of steel, turned and finished, with case-hardened screws. All the parts are case-hardened when desired. They are made in two sizes, the length being 2" and 3" with a raise of 1" and 1¾" respectively. They are made by the Energy Mfg. Co., Philadelphia, Pa.

### F. C. Vanderford.

F. C. Vanderford, an old-time machinist, died, recently, at Fitchburg, Mass., in the 67th year of his age. In 1836 Mr. Vanderford began an apprenticeship with John and Salmon W. Putman, and the three comprised about all the machinists there were in Fitchburg at the time. He remained with them and their outgrowth—the Putman Machine Co.—as long as he was able to work.

As a workman he was, so to speak, a connecting link between old-time and modern methods. In his early days the custom, largely brought to the front by the Putmans, was in the direction of a good deal of ornate finish. Mr. Vanderford was an adept at this, and his taste in producing the prevailing forms of that time was proverbial in the shop. The "hand-tool," that is, the American type of hand-tool, was largely in use in his early days, and his fine sense of taste helped him to use it with surprising effect in producing ornamental forms. The writer of this has shopmated with him, and knows whereof he affirms as to his ability as a mechanic, and adds his testimony to others as to his good qualities of heart as well as of hand. As a mechanic, Mr. Vanderford has, in an unostentatious manner, helped to improve things in a way that makes him a benefactor.

He has outlived the entire management of the Putman Co., and the middle-aged men who have succeeded the veterans in the management, and the old employes of the company, reverently laid him away for his final rest.

### Horizontal Boring Machine.

On this page we present an engraving of the horizontal boring machine built by the Betts Machine Co., Wilmington, Del., the company having recently added some improvements, which increase the convenience of handling, and the capacity of the machine. The spindle can be driven at ten different speeds in either direction, and passes through a cast-iron shell which drives it, and in which it has at all times a full bearing. Spindle is of steel, has a full range of automatic feeds, which can be conveniently manipulated, and can be moved by hand, either by a slow or rapid motion. After the spindle has been fed through to the extent of its continuous travel, it can be left in position, while the feed slide is moved back and secured to it at another point, thus enabling the machine to bore a length of hole up to twice the normal capacity of the machine. To the outer end of the cast-iron driving shell is fitted a facing head, with which work can be faced, while being bored, this operation in no way interfering with the boring. The room required in which to swing this head is always the same, and less than was necessary with the older style, thus allowing the table to be brought up closer to the spindle.

The long table is raised and lowered by power, and is provided with the usual arrangement of compound tables and slides on top, which are adjusted by means of screws, and can be firmly clamped in any position. The machine is especially designed for heavy duty, and is undoubtedly well adapted to its intended purpose.

Mr. C. A. Schieren, of the firm of Chas. A. Schieren & Co., has been appointed one of the Committee for the International Exposition of 1892, to represent the leather belting industry.

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## Machinists' Exaggerations.

A machinist of our acquaintance, who, besides being a very good mechanic, is something of a philosopher as well, having brought out a new tool of considerable merit, commences a descriptive circular in the following language:

It has always been customary, and perhaps always will be, for advertisers to use extravagant language in describing new goods. From the mammoth circus-poster, with its impossible horses and imaginary riders—who utterly ignore the laws of gravitation—down to the modest "ad," which proposes to "grow a heavy beard on the smoothest face in ten days," there appears this almost universal tendency to exaggerate, which, "though it may split the ears of the groundlings, can but make the judicious grieve." As the size and power of cannon have increased, ships' armor has been strengthened to withstand the shot; so as the advertiser has enlarged upon the merits of his wares, the reader has come to discount his statements proportionately. For this reason, I refrain from printing many of the good things I believe about the tool here illustrated.

It is true, as our friend remarks, that machinists are not so much given to exaggeration as some others, but still it is likely that there is enough exaggeration by them to cause some discounting by the shrewd buyer, and the worst feature of the case is that by the undiscriminating this discount is very apt to be applied to all alike—to those who make it a point never to exaggerate as well as to those who habitually do so. Of course the reason for machinists not exaggerating as much as some others who have things which they desire to convince people of the necessity for buying is not to be found in, and modesty would forbid our attributing it to inherent and natural superiority of machinists over other people. It is attributable, no doubt, chiefly to the nature of their business, which has little of the imaginative in it, and with which, therefore, exaggeration does not seem to agree very well. The machinist deals with exact facts, and with things which are measurable and weighable. He knows that almost everything done by him can be accurately and surely tested by others as well as by himself, and that the degree of accuracy and efficiency attained in the construction of any of his productions can be accurately determined and stated in distinct terms, with figures to support it. His entire training is such as to tend to make him avoid exaggeration; and, generally speaking, the better the training and the better the business, with its possibilities and limitations, is understood, the less the exaggeration. The man who makes his money by selling patented nostrums to people who are, or who imagine themselves to be sick, must exaggerate; his business demands it. The imagination of his prospective customers must be worked upon to create an imaginary disease, from which there is no escape except by taking "this greatest of modern medical discoveries." The imagination is then depended upon entirely for the cure, and since the success of the business depends so much upon imagination, it is, of course, appropriate to appeal entirely to the imagination in the advertising. The machinist cannot do this, even if he were so disposed. Every claim made for his productions can be proved or disproved by means which leave nothing to the imagination, and admit of little or no dispute.

But the wise machinist, like other wise people, adapts his ammunition to the game he is after, and it will be found that, as a rule, the amount of exaggeration indulged in by him bears some relation to the general intelligence and knowledge of the machine business possessed by the people appealed to. The machinist who makes engines for threshing machines knows that the kind of descriptions which would be entirely suited to the machine tool business would be altogether out of place here, and that a modest pamphlet, confined to plain and exact statements of fact as to the construction and performance of the engine, would utterly fail to impress the young farmer boys who usually buy them, and would result in few if any sales. The builders of harvesting machinery have found that one of the worst faults of such machinery, in the eye of the farmer, is heavy draught; and, therefore, each and every manufacturer unblushingly proclaims his machine as being more easily pulled about a harvest field than any others made or possible to make, and their pictures of the machines in operation always show the horses prancing gayly through the field, paying no attention to anything in their rear, and with the traces hanging slack, indicating that all that is necessary in cutting and binding wheat, is for the horses to trot fast enough to keep their heels out of the way of the advancing machine—an example of the adaptation of ammunition to the game.

The machinist who constructs large stationary engines which he guarantees to produce power at a given consumption of coal per horse-power per hour, can depend very little upon imagination; power can be accurately measured and coal can be accurately weighed. It is much the same with the machine tool business. Most machine tools go into the hands of people who know more or less about machinery and can make accurate and conclusive comparisons between the performances of various machines of the same class. Most builders of threshing machine engines would decline to buy tools for use in their shops which were advertised in the extravagant terms employed by themselves in selling their engines.

While it is undoubtedly true that the nature of the machinist's business is not on the whole so favorable to the formation of the habit of exaggeration as some other lines of business, there is still more of it among them than some would like to see (and none are in a position to know this better than ourselves), yet it will be found that where it occurs it is usually properly discounted by prospective purchasers who are capable of judging of the merits of a machine, while those who fail to make the proper discount would probably utterly fail to appreciate such machinery as is usually advertised in terms which call for no discount.

A great deal of apparent exaggeration is no doubt due to the fact that the standard of workmanship differs so widely in different shops. A man who advertises his patent wimwam as being constructed in the best manner known to the machinist's art may honestly think it is so constructed; while others having a different standard of workmanship would as honestly consider the machine very poorly built. The expression "first-class workmanship" means nothing unless we know something of the standard of first-class workmanship in the shop in question. However regrettable exaggeration may be, we can see nothing in the situation which should deter makers of good machinery from stating the facts regarding it. In the end, we think these things adjust themselves to about the proper level. There are some consoling features connected with almost every evil, and exaggeration in advertising is no exception to the rule.

## Engineers' License Bill in the District of Columbia.

We have received a copy of a bill in relation to the licensing of stationary engineers in the District of Columbia, which is likely to come up for final action at the next session of Congress. We have examined the bill with considerable care, and see no reason why it should not become a law. It provides that stationary engineers in the district shall be submitted to reasonable examination, and shall not be allowed to ply their vocation in the district without a license. To receive a license, a man must be of temperate habits, and must be vouched for by not less than three reputable citizens of the district.

Engineers are divided into three classes, to cover positions more or less important, and it is provided that no license shall be required in the case of boilers used for heating or cooking purposes, where the water returns to the boiler without the use of a pump or injector.

As we have intimated, the bill is a moderate one, not intended to prevent any one acting as engineer, who is capable of doing so properly.

There is no doubt that in this case, as in other attempts to secure a law for licensing engineers, engineers themselves are the moving spirits, and this often causes such efforts to be looked at with distrust. We think this is unfair to engineers. The National Association of Stationary Engineers is in no sense of the word a labor organization, except that its membership consists of men who do or have worked as engineers. The members of this organization have been working for some years to improve themselves, and they know the danger of placing irresponsible men in charge of steam plants where life and property are exposed. They do not ask that engineers shall belong to any organization, but simply that they shall know something of their duties. The Association naturally moves in these matters because the organization puts their members in condition to do so. In this respect they are no different from the medical fraternity, or the lawyers of the country.

Believing that the bill that is to come up for action in the next Congress is for the welfare of all the people, we shall watch with interest the course taken in regard to it.

## Literary Notes.

We have received from the Secretary, Jno. W. Cloud, a copy of the Proceedings of the Master Car Builders Association for 1889. The work is very complete, and should be in the hands of every one interested in railroad work. We believe it can be obtained for $1.50 per copy by addressing the Secretary, 31 White Building, Buffalo, N. Y.

## QUESTIONS AND ANSWERS.

*Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common-sense methods.*

*Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.*

(429) W. C., Peterboro, Ont., asks: 1. Will you inform me as to where I would get a book giving me a good insight into the machinist business? *A.*—There is no book which will do this, and there never will be one. 2. Will you give me the rules for cutting screws in simple and compound geared lathes? *A.*—See answer to Question No. 70, issue of Feb. 14.

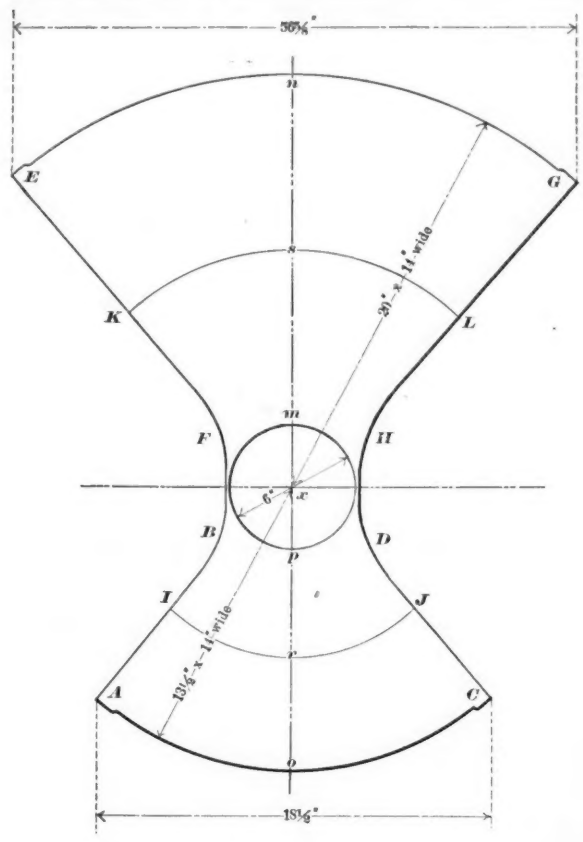
(430) F. S. H., West Chester, Penn., writes: Please tell me what studies should be pursued to enable one to become a mechanical draftsman. *A.*—Arithmetic, geometry, algebra, descriptive geometry, natural philosophy, trigonometry, strength of material. 2. Where can I get a book containing the principles of drafting? *A.*—See articles on Practical Drawing, now running in the AMERICAN MACHINIST.

(431) J. C. S., Cincinnati, O., asks: How do you find the area of a safety valve? *A.*—For the purpose of making the calculations relating to the weight, lever, etc., the area of the safety valve is taken equal to that of the safety valve opening. The area of the opening you may find in any engineers' pocket book, under the head of areas of circles. 2. Where should the weight be placed on the lever? *A.*—That will depend on the steam pressure. See answer to Question 404 in our issue of October 31, 1889.

(432) A. E. D., Winnipeg, Canada, asks: Can cast-iron be hardened to give good results for link blocks? *A.*—Yes; heat to a cherry red, apply potash, and dip it into water, the same as is done for wrought iron. Some mechanics repeat this process two or three times. The potash should be pulverized, so as to melt readily. Care will also have to be taken in reheating the piece, as the potash is likely to burn off, and thus leave the iron soft. See AMERICAN MACHINIST, Feb. 25, March 10, 17, 31, and April 7, 1888.

(433) J. S. R., Philadelphia, Pa., writes: In answer to my question relating to the blow of the steam hammer, you referred me to Question 240. I understand all but one thing, which is the following: You have $\frac{1,056 \times 50^2}{2} = 130,000$ foot pounds; I can only make the following: $\frac{1,056 \times 50^2}{2} = 1,320,000$. Will you explain? *A.*—You are right; we accidentally dropped a cipher. This will, of course, change the values which follow the error.

(434) G. W., Brooklyn, N. Y., asks: Please inform me and others if it is one of the necessary




parts of a student's course in mechanical drawing to make free-hand sketches of wooden models, such as cubes, prisms, etc.? Is it not better to make free-hand sketches of parts of machinery and tools? *A.*—The draftsman is often called upon to make free-hand sketches, and these should be well made, like everything else. To learn to make good free-hand sketches of machinery it is necessary that the student should be able to make sketches of simple geometrical objects, of which the different parts of machinery are mostly composed. We believe that the student cannot have better practice than the sketching of such geometrical objects as cubes, prisms, cylinders, etc. A good teacher will be able to make such a course very interesting and instructive to his progressive scholars.

(435) New York, ———, asks: What will be the indicated horse-power of a non-condensing compound Crist engine? the dimensions of the cylinders are given in the accompanying sketch. *A B C D* is the high-pressure cylinder, and *E F G H* the low-pressure cylinder. The pistons oscillate on the center *x;* thickness of pistons, 1½ inch; piston clearance at each end, about ⅛ inch; number of strokes, 400; steam is cut off in the high-pressure cylinder at ⅜ stroke; boiler pressure, 90 pounds. Please give rule. *A.*—According to the dimensions given on the sketch, the length *p o* of the high-pressure cylinder will be $13\frac{1}{8} - 3 = 10\frac{1}{8}$ inches, and, since the given width is 14 inches, the area of this piston is $10.5 \times 14 = 147$ square inches. The length *m n* of the low-pressure piston will be $20 - 3 = 17$ inches, and its area $17 \times 14 = 238$ square inches. Our next step will be to find the stroke of the pistons. Bisect the length *o p* of the high-pressure piston in the point *r;* from *x* as a center, and with a radius equal to *r x*, describe an arc *I J;* measuring this arc, we find it to be, say 13 inches long; deducting from this length the thickness of the piston and the clearances, namely, $1\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = 2\frac{1}{8}$, we have $13 - 2\frac{1}{8} = 10\frac{1}{8}$ inches for the stroke of the high-pressure piston. In a similar way we find the stroke of the low-pressure piston, thus: Bisect *m n* in the point *s;* from *x* as a center, and with radius equal to *s x*, describe an arc *K L;* measuring this arc we find it to be, say 17 7 inches long; deducting from this arc the thickness of the piston and amount of clearance, we have $17.7 - 2.5 = 15.2$ inches for the length of the stroke of the low-pressure piston. In calculating the horse-power of a compound engine it is customary to assume that the total expansion occurs in the low-pressure cylinder, and it is also assumed that the expansion curve is a rectangular hyperbola. We must therefore first find the volume of steam admitted in the high-pressure cylinder during one stroke. Since the stroke of the high-pressure piston is $10\frac{1}{8}$ inches, and its area is 147 square inches, the displacement of this piston will be $10.5 \times 147 = 1,543.5$ cubic inches; multiplying this displacement by ⅔, we have

$$\frac{1,543.5 \times 2}{3} = 1,029 \text{ cubic inches of steam admitted}$$

during each stroke. The displacement of the low-pressure piston is equal to its area multiplied by the stroke, hence we have $238 \times 15.2 = 3,617.6$ cubic inches; dividing this by the volume of steam, we obtain the ratio of expansion,

$$\frac{3,617.6}{1,029} = 3.5 \text{ expansions.}$$

To find the mean effective pressure look for this ratio (3.5) in a table of hyperbolic logarithms, which may be found in some of the engineers' pocket books, or books treating on steam. Opposite the number (3.5) will be found 1.253; add 1 to it, and thus obtain 2.253; multiply 2.253 by the absolute steam pressure, which is $90 + 15 = 105$ pounds,

$$2.253 \times 105 = 236.565.$$

Divide this last product by the ratio of expansion

$$\frac{236.565}{3.5} = 67.59 \text{ pounds effective}$$

pressure. Subtracting the back pressure, say 18.59 pounds, we have $67.59 - 18.59 = 49$ pounds mean effective pressure. Now to find the horse-power, we proceed in the same way as we would do for finding the horse-power of any simple engine, namely, multiply the number of feet through which the low-pressure piston travels per minute, by the area of the piston and by the mean effective pressure, and divide the product by 33,000. The stroke of the low-pressure piston we have found to be 15.2 inches; the piston making 400 strokes per minute, we have

$$\frac{15.2 \times 400}{12} = 506.66 \text{ feet through}$$

which the piston travels per minute.

$$\frac{506.66 \times 238 \times 49}{33,000} = 179 \text{ indicated horse-power.}$$

In the foregoing we have not taken the effect of the engine clearance or the receiver into account, consequently 179 horse-power should be considered to be only a close approximation. If the engine exhaust into a condenser so as to make a condensing engine out of it, the I. H. P. will be about 223.

## BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday for the ensuing week's issue.*

Gear wheels and g-cutting. Grant, see adv., p. 16.

Link-Belting and Sprocket Wheels.

Send for Catalogue of Link-Belting.

Over 50,000,000 feet of Link-Belt in use.

Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Steel Name Stamps, etc., J. B. Roney, Lynn, Mass.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"The Bulldozer," a new departure; forging by pressure. M'f'd by Williams, White & Co., Moline, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Prestoline & Prestoline Paste, for cleaning & polishing metals. S. A. Smith, 23 S. Canal st., Chicago.

Ice and Refrigerating Machines, 140 sold, and all successful. David Boyle, 521 Monroe st., Chicago, Ill.

Iron Planers from 16" to 36" wide by any length. H. C. Pease & Co., Worcester, Mass.

Patent Attorney. R. G. DuBois, 715 11th st., Wash., D. C., procures first-class patents for inventors.

Valve Seat Rotary Planing Machine. Pedrick & Ayer, Philadelphia, Pa.

Cylinder Boring and Facing Machines. Pedrick & Ayer, Philadelphia, Pa.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n.

For the latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

The hook on steam engines is being supplanted by the Dill disconnecting device made by the T. C. Dill Machine Company, 726 Girard ave., Phila., Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Nov. 14, p. 10. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

Screw Plates with Round Adjustable and Split Dies; also, Tap Wrenches. A full line by S. W. Card & Co., Mansfield, Mass.

25" 28" 32" 36" Upright Drills a specialty. Finely made, great capacity, quickly operated, prices low. Send for list of firms using our Drills. J. E. Snyder, Worcester, Mass.

25" 32" 37" 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Steam Boilers: Their management and working on land and sea. By Jas. Peattie. Practical facts from 30 years' experience. 230 pages. Illustrated, 12mo., cloth, $2. Circulars and Catalogue of Books for engineers free. E. & F. N. Spon, 12 Cortlandt st., N.Y.

De Lamater Screw Propeller Wheel, made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

"Inventors' Manual. How to Make a Patent Pay." Treats on how to invent, how to interest capital, how to estimate the value of a patent, hints on selling patents, on formation of stock companies, forms for assg'ts, licenses, etc. Price by mail, $1; cloth. J. F. Davison & Co., Publishers, 120 Broadway, N Y.

H. B. Roelker, 22 Cortlandt st., New York, late Sup't Delamater Iron Works, will hereafter manufacture the Delamater Screw Propeller. Propellers of same pattern and workmanship as formerly made by the Delamater Iron Works. Each designed for its special work at lowest prices. Consulting Expert and Constructing Engineer. Estimates made on machinery and on damages.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

Patterson, Gottfried & Hunter (Lim.), 146-150 Centre st., N. Y., carry a complete stock of Brush, Copper, Celluvert Fiber, Oiled Paper, Hard Rubber, Rod & Sheet Brass, Brass, Copper & Iron Wire, Self-Hardening Tool Steel, Set & Cap Screws, Machine Bolts, Machine & Wood Screws, Taps & Dies, Files and Twist Drills, Blowers & Forges, Machinery, Tools & Hardware, Gear Wheels, Wood Pulleys, Shafting, Hangers & Belting. General factory supplies.

"Modern Locomotive Construction." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 101 articles have thus far appeared up to and including the October 3, 1889 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Practical Drawing." By J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including October 10, 1889 issue, 87 articles have been so far published. Copies containing these articles sent by mail to any part of this country or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

C. H. De Lamater & Co. have closed their extensive manufactory at the foot of West 13th street, New York, and have sold the Hot Air Pumping Engine and Steam Pump business to the De Lamater Iron Works (incorporated in 1889), and the Propeller Wheel business to the Samuel L. Moore & Sons Co., of Elizabethport, New Jersey.

In order to close out the remainder of the stock, offer for sale a very desirable lot of machinery, such as lathes from 15" to 88" swing, planing machines 48"x45"x10', 53"x50"x12', 17"x14"x24', 72"x69"x24', and various other sizes; drilling machines, slotting machines, shaping machines, boring machines, bolt-cutting machines, cutting-off machines, nut tappers, milling machines, gear cutters, emery tool grinders, portable drills, screw-cutting machines, vises, lathe and planer tools, and a variety of small tools; also traveling and jib cranes.

Punching and shearing machines for boiler makers, with a general outfit of small tools. Blacksmiths' tools, such as anvils, sledges, tongs, etc. Pattern lathes, benches, saws, screws, nails, and a general supply of small tools. Foundry cranes, cupolas and small tools. Blocks, ropes, bolts, nuts, washers, packings, pipe and fittings, iron and brass valves. Boiler iron, steel plate and boiler rivets. Bar iron and steel; also steam hammers, and two 8"x16" and one 10"x20" Rider cut-off engines.

## MANUFACTURERS

Charles Green will build a planing mill at Fort Myers, Fla.

The Enterprise Brass Co., St. Louis, Mo., will increase their plant.

The Williamson Belting Co., St. Louis, Mo., will increase their capital stock.

A paper box factory is about to be established at Durham, N. C., by Duke & Son.

A stock company is being formed at Blacksburg, S. C., to build a large foundry.

A stock company for the manufacture of matches has been organized at Macon, Ga.

A large iron and steel works will be built at Middlesborough, Ky., by English capitalists.

E. P. Allis & Co., Milwaukee, Wis., are sending an entire outfit for a flouring mill to the Argentine Republic.

J. J. Ryan, brass founders and finishers, Chicago, Ill., have largely increased their facilities to meet their growing trade.

The Westinghouse Electric Light Co., Pittsburgh, Pa., are working on a contract for a large electric light plant in Pekin, China.

The Norton Emery Wheel Co., Worcester, Mass., are at work on the addition to their plant. The addition is 48x48 feet.

A company has been formed, in which George W. Bonham is interested, to build a machine shop and foundry at Laredo, Texas.

The capital stock of the Wetmore Shoe and Leather Company, of Raleigh, N. C., has been increased from $25,000 to $40,000.

Hill, Clarke & Co., Boston, Mass., have received an order for a complete outfit of tools for the Michigan School of Mining, Houghton, Mich.

Col. J. H Sands and others have incorporated the Roanoke Iron Company at Roanoke, Va., to build an iron furnace. Capital stock, $1,000,000.

The Columbus (Ohio) Architectural Iron Works have received an offer that may induce a removal to Little Rock, Ark.

The Byden Horse Shoe Co., Catasauqua, Pa., is building new works that will largely increase their output. The company has recently increased its capital stock to $100,000.

There is water-works agitation at Jacksonville, Fla.; Atlanta, Ga.; Pottstown, Pa.; Seattle, Wash.; Little Falls, Minn.; Oxford, Miss.; Yazoo City Miss.; Marshall, Minn.; Ludlow, Ky.

The shops of the Memphis & Charleston Railroad, at Sheffield, Ala., will consist of a machine shop, 100x200 feet, a blacksmith and boiler shop, 90x200, feet, and a wood-working shop, 90x200 feet.

The Cushman Chuck Co., Hartford, Conn., have nearly doubled their capacity during the past summer. Additions have been made to their factory, and they have made large purchases of machinery.

The *Commercial Bulletin* says: "Two new shops are building in Beverly, Mass., to be let, when completed. They are of brick, 150x60 feet, four stories high. The walls are already up and roof on.

The Works of the Hood & Murray Machine Co., St. Louis, Mo., were recently badly damaged by fire, but the company immediately opened in new quarters, and the result of the fire will probably be an extension of their works.

A company has been organized to build a railroad spike factory at Scottdale, Pa., with a capacity of 100,000 kegs annually. The spike machine to be used is an invention of Artemus Welsh, of Scottdale, and the late A. A. Hood, of Connellsville.

The Beecher Manufacturing Company, of Meriden, Conn., has introduced the use of petroleum at its factory, at present having one forge running by its use as fuel. This is to be followed soon by having all the fires in the shop run by oil as fuel.

The E. Horton & Son Co., Windsor Locks, Conn., makers of the Horton chuck, have recently been adding largely to their lists of chucks, making their sizes more complete in every respect. One of their more recent additions is to their line of independent reversible jaw chucks. They now make these chucks in 18 sizes—from 4" to 38".

From the younger Mr. Stiles, manager of the Stiles & Parker Press Co., Middletown, Conn., and Mr. Fladd, the Company's New York manager, who called upon us recently, we learn that the business of the company is showing a healthy increase. They are at work on the addition to their buildings, which we have previously noticed, and which, when completed, will very materially increase their facilities.

The Ashcroft Manufacturing Co., 111 Liberty street, New York, have issued in pamphlet form a book on The Tabor Indicator, designed for free distribution amongst engineers. It is mainly a reprint of their previous work, revised so as to cover the present construction of the indicator. The book contains information in regard to taking diagrams and working them up, a price-list of the indicator and appliances, and a large number of testimonials.

Eastern and Pittsburgh capitalists are about to inaugurate a great glass enterprise near Pittsburgh, Pa. The invested capital will be $3,500,000. On a tract of 500 acres, embracing one and one half miles of river front in the Monongahela Fourth pool, there will be erected, among other factories, plate-glass works 1,500 feet long, and employing at the outside nearly 3,000 men. The purchase price of the tract was $250,000, and the options were closed and deposits made last week.

The Crescent Steel Works, office, 480 Pearl street, New York, have issued a circular slip to their customers as follows: "There may be times when you want, promptly, a size or grade of steel not in store at your usual source of supply, which we can ship on receipt of order. We offer you a large stock, prompt service, and steel so uniformly good as to warrant your regular use of it for all purposes. The products of the Crescent Steel Works have long been recognized as equal to the best English steels, and superior to most of them for the continuous hard work which tools have to do in these days of close competition." The Crescent Steel Works also make to order die blocks, coiled springs, lathe spindles, and steel forgings of any kind.

The Hall Steam Pump Co., 91 Liberty street, New York, send us their 1890 catalogue, which is very nicely arranged, printed and illustrated. They also send us the following: It is with much pleasure that we inform our old customers, and those interested in pumping machinery, that, on November 15 we will be settled in our large and new pump works at Pittsburgh, Pa. Our main building is 60x250 feet, of brick and iron, built especially to suit the requirements of a first-class machine shop. Connected with it is the brass and iron foundry. At considerable distance from the machine shops is another fire-proof building, for the storage of patterns, etc. All are located on a large plot of ground, giving ample yard room. Every department is fully equipped with new machinery of the very latest and best make, with numerous special tools, designed to turn work out rapidly, economically and well, and with competent men of full experience in charge. The situation of the works is a very desirable one, being located in the best fuel and iron district, central for shipments, and surrounded by an abundance of good mechanics. We are now prepared to take orders for large work as well as small, and can promise early execution as well as good work. We invite correspondence with us before placing orders elsewhere. To our old customers we need not say anything in regard to the merits of the Hall duplex steam pump. To those who have not patronized us, we say, give us an opportunity to prove that we can best serve you.

## Machinists' Supplies and Iron.

NEW YORK, Nov. 16, 1889.

Iron—American Pig.—The tendency of prices is still upwards, and it is difficult to get first-class brands. Quotations are somewhat uncertain, but are about as follows: No. 1 X Foundry, $18.50 to $19.50; No. 2, $17.50 to $18.50. Southern brands, No. 1, $17.50 to $18.50; No. 2, $17 to $17.50.

## ✲WANTED✲

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

Competent agents wanted to represent a meritorious & paying steam specialty. Business, AM. MACH.

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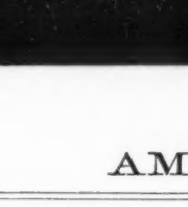

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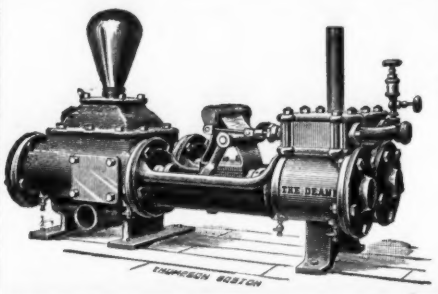

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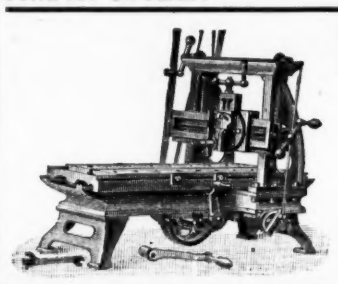

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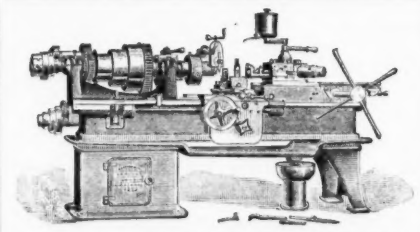

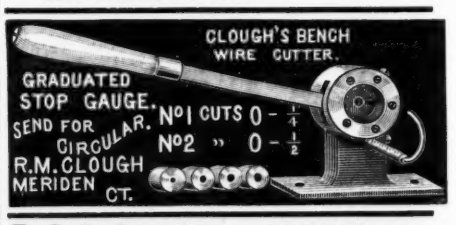


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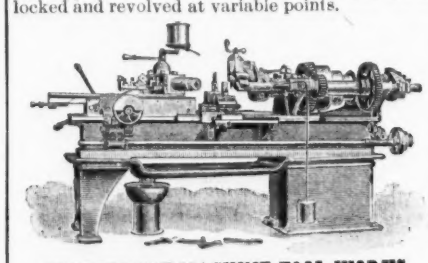

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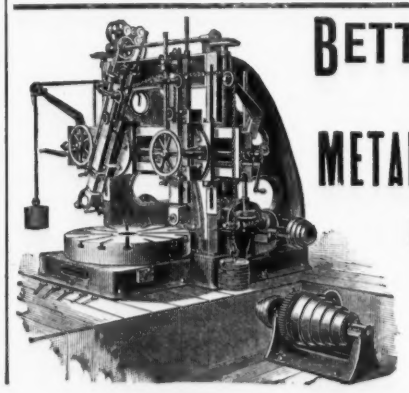

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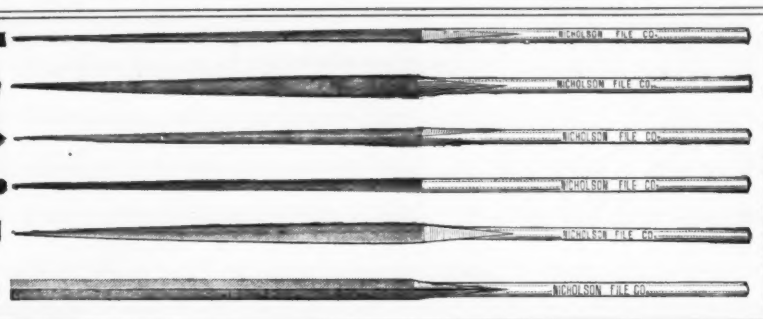


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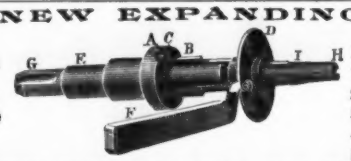


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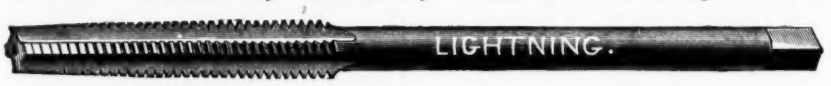


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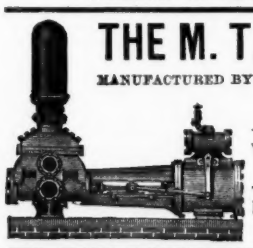

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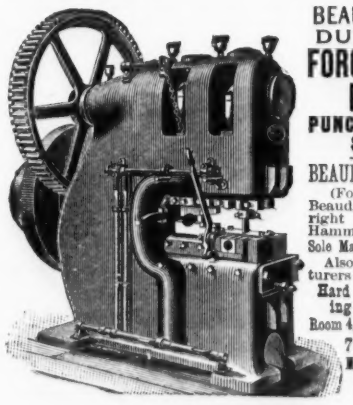

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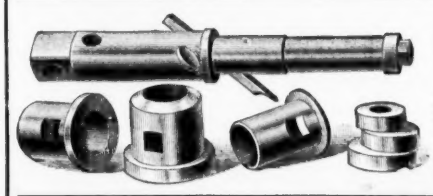

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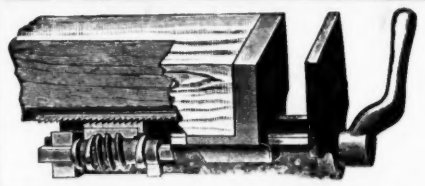

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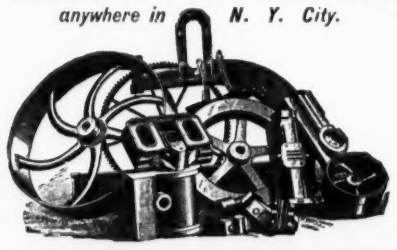

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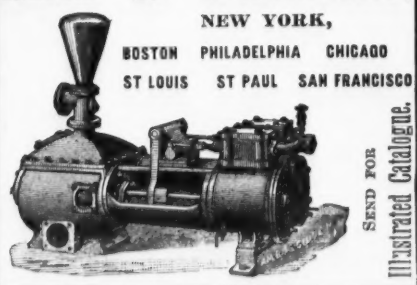

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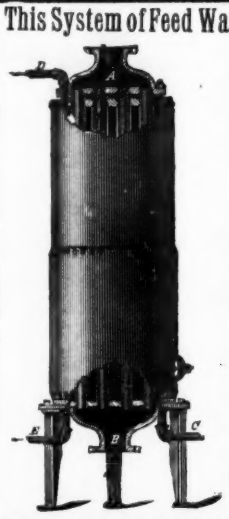

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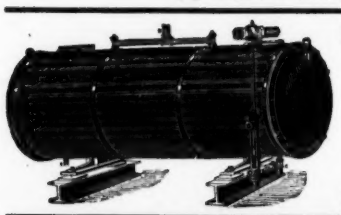

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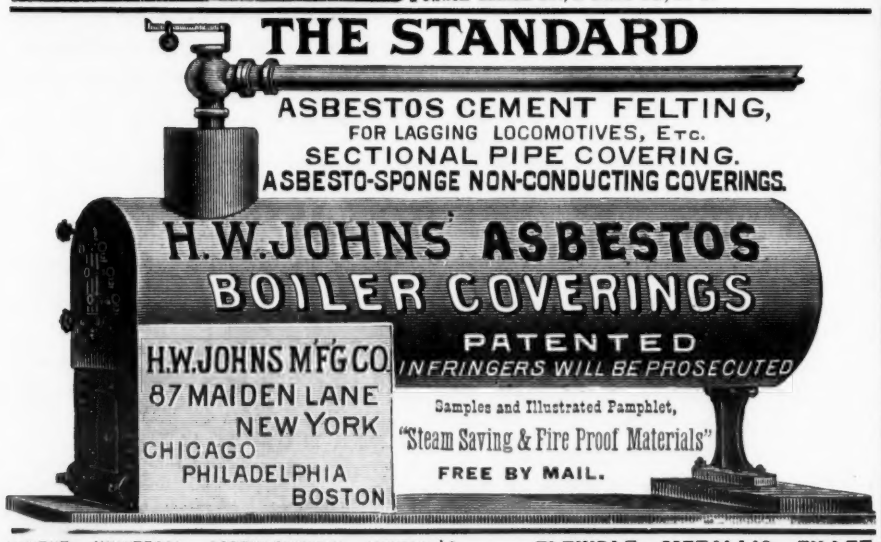


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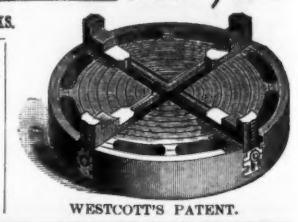

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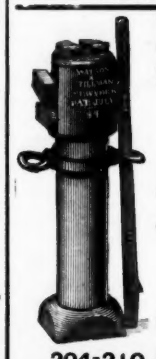

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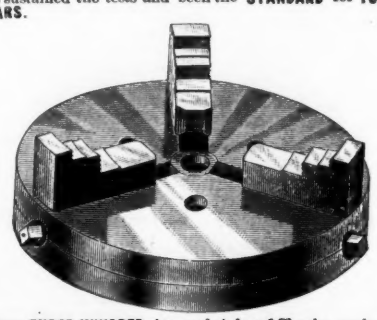

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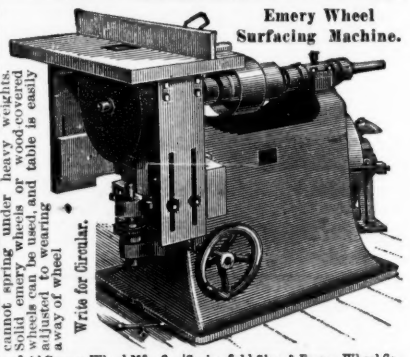

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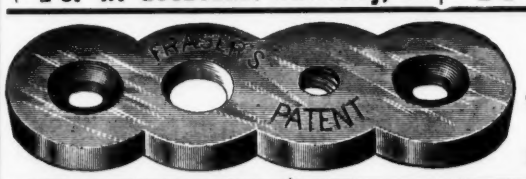


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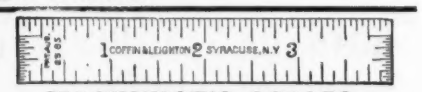


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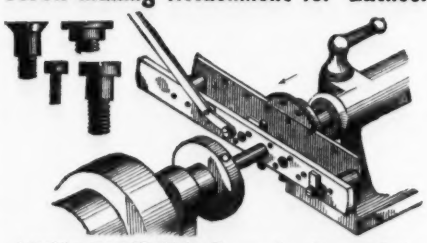

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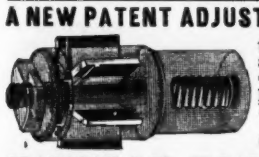

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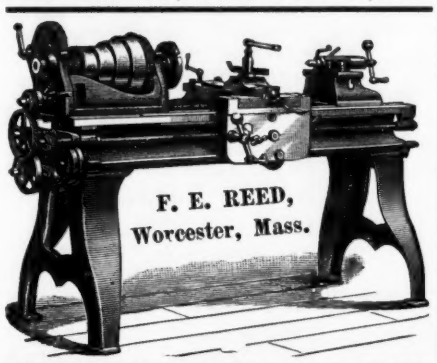


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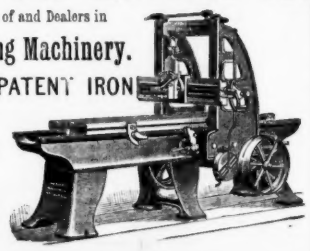

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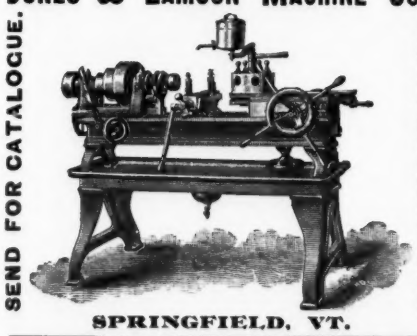

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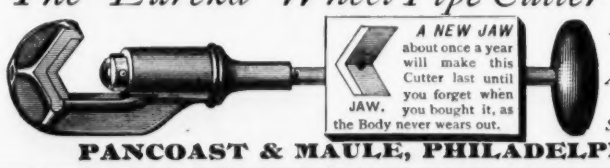


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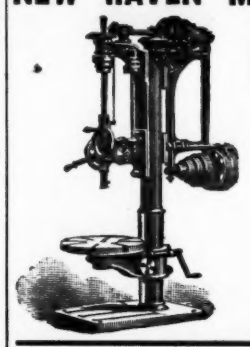

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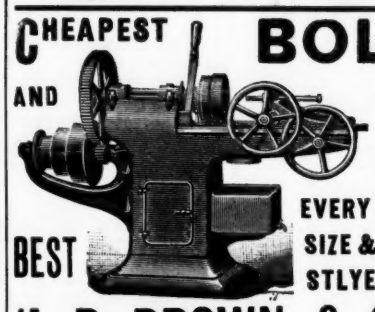

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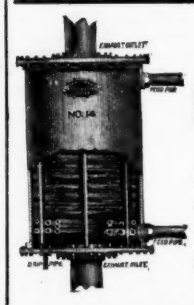

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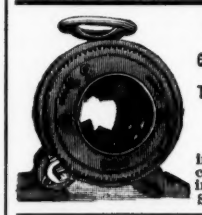

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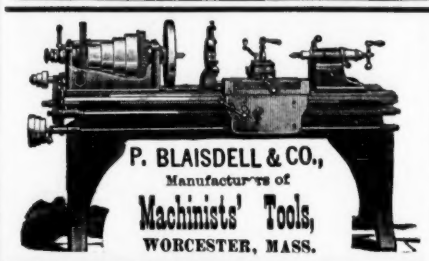


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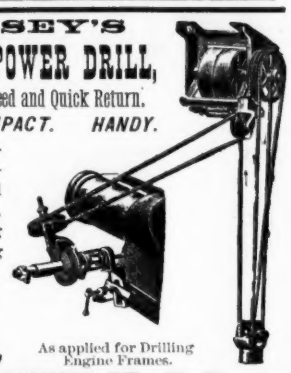

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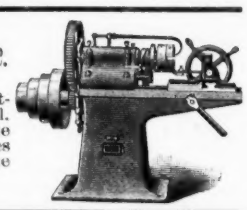

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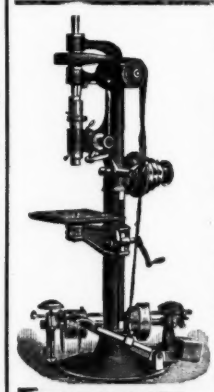

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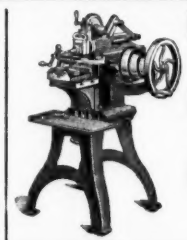

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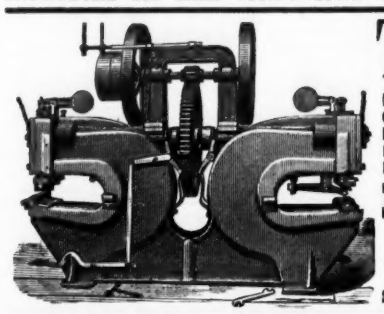

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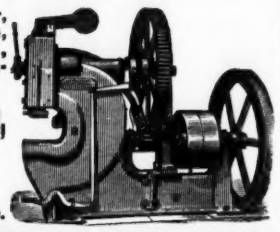

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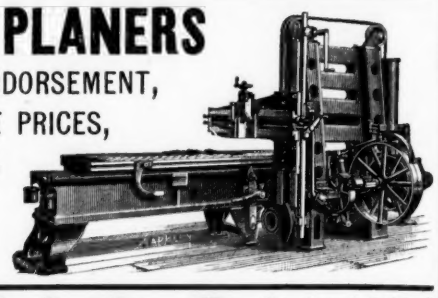

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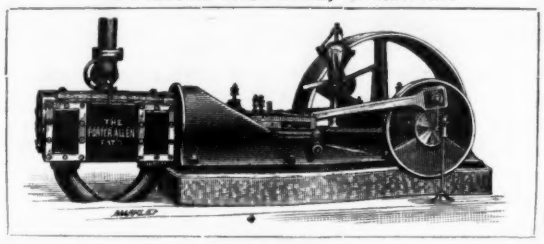

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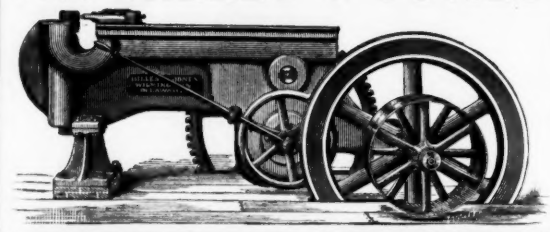

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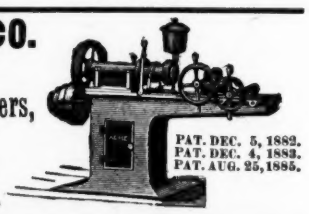


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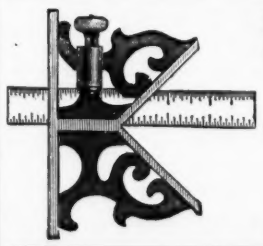

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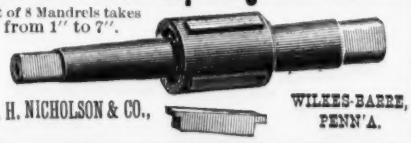

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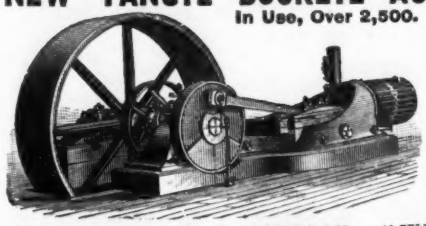

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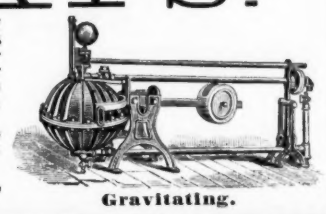

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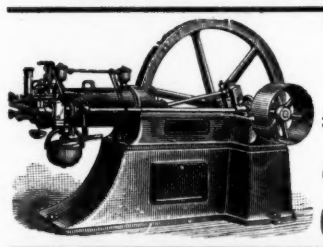

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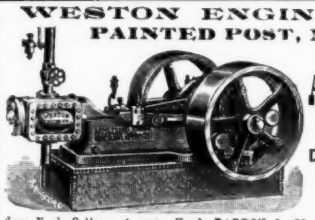

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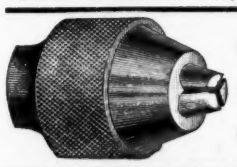

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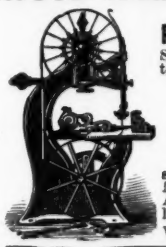

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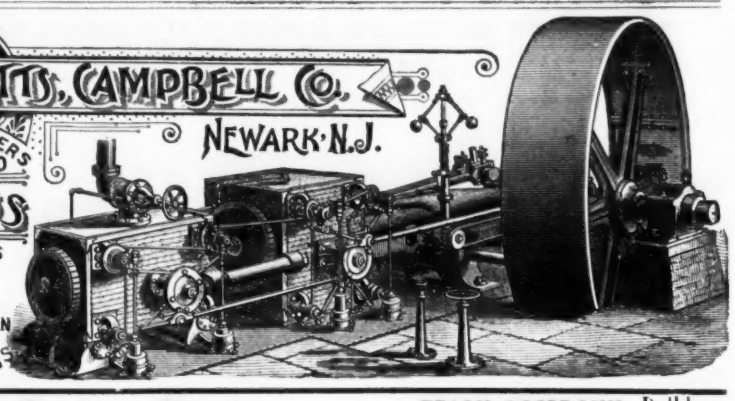

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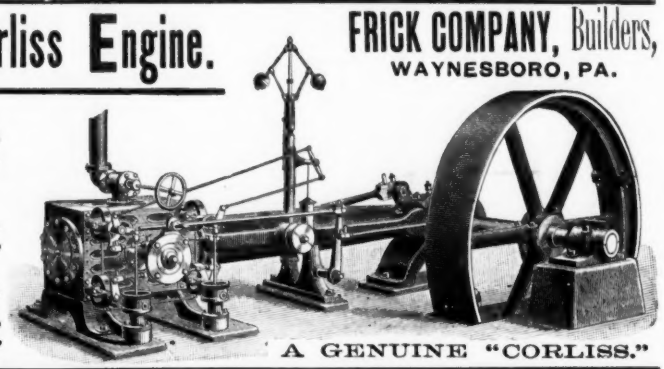

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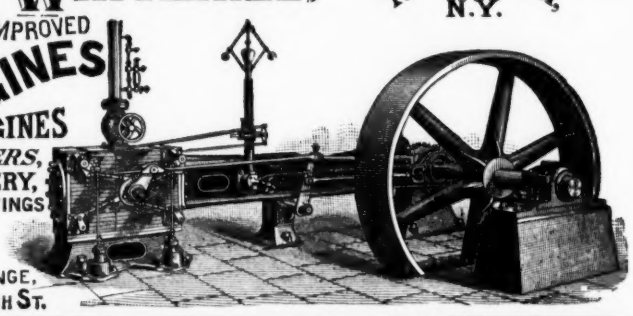

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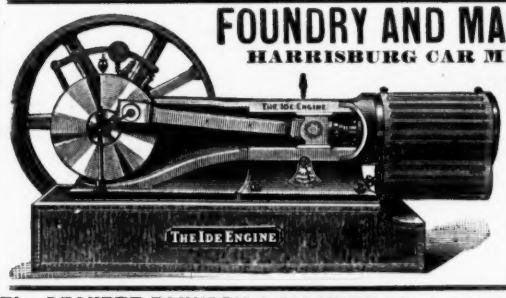


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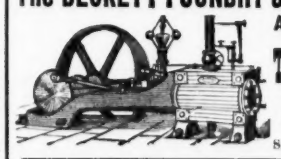

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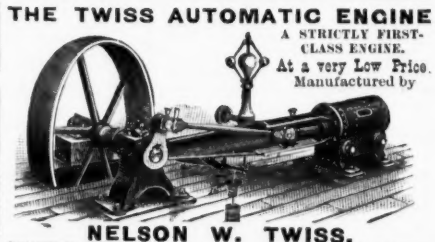

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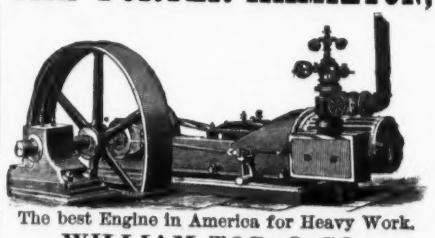

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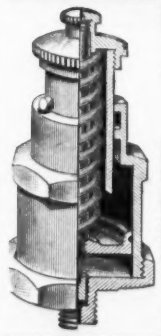

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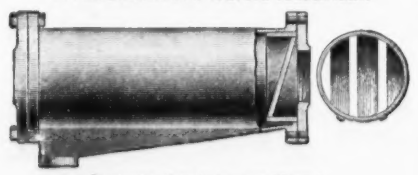

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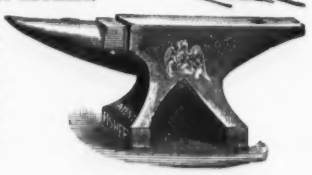

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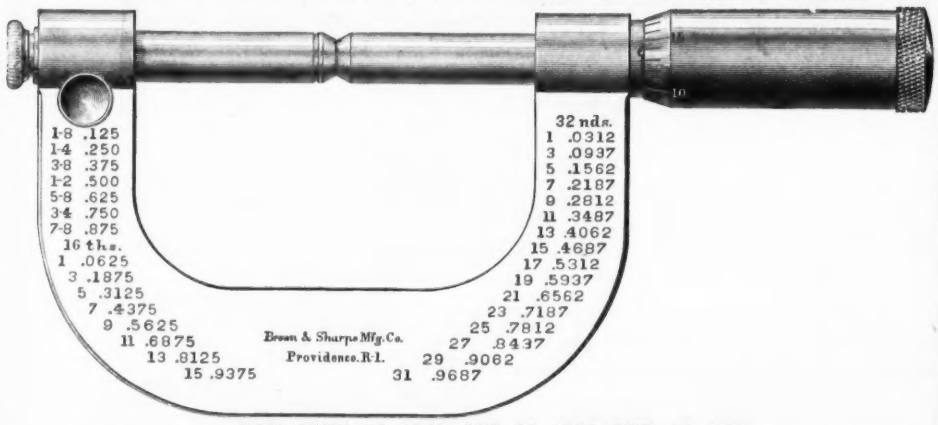


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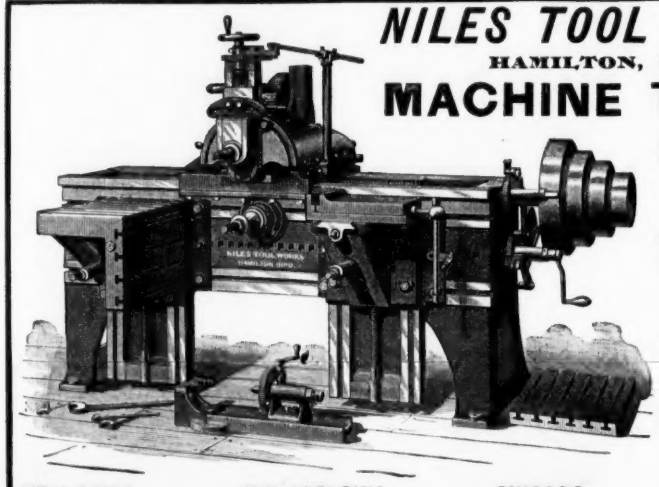

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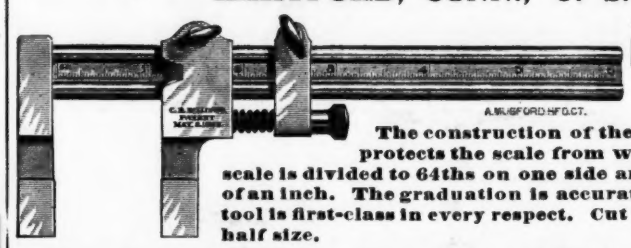

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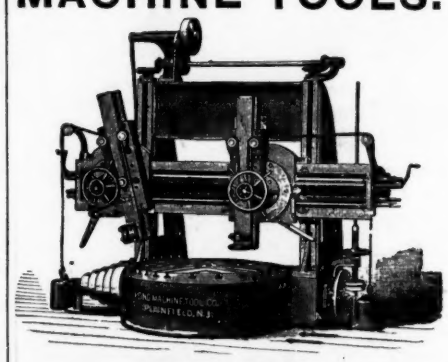

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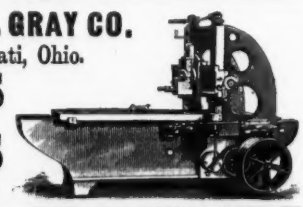

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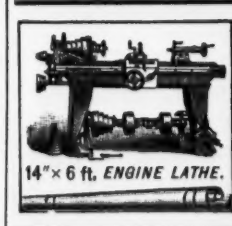

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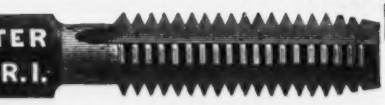

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